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Troubles for the Reclamation Service.

The great irrigation enterprises of the United States Reclamation Service are developing various unjust criticisms of the way the work is managed, which deserve just enough attention to show their unreasonable nature. They come from the man who has looked upon the Reclamation Act as a certain means of transferring himself from the back of a moth-eaten bronco to the most palatial barroom in New York, and from the inexperienced contractor who sees in the numerous enterprises of the service an opportunity for large profits. Both men are deceiving themselves sadly. The United States Government has not undertaken to water every patch of sagebrush big enough to shelter a jack rabbit, and any contractor who dreams that the United States prepares plans, specifications and contracts for the purpose of permitting the work to be done in a different manner from that designated ought to wake up right away.

Under the terms of the law governing this act a large number of projects have been surveyed. These examinations were made in order to obtain the information needed in determining the relative merits of the different schemes. Many projects have been advocated by earnest adherents who would be indignant if told that they did not know what they were talking about, because they had never collected the data on which alone an estimate of the merits of their plan could be made with any certainty. On the other hand, decidedly meritorious projects have been kept in the background because nobody was interested in pushing them into public view. Consequently the service has been surveying far more projects than can possibly be executed in the near future. These investigations have not been made because somebody asked for them, but because the national character of the federal irrigation undertakings makes it necessary to have at the head offices a fair statement of the conditions of every such project worthy of consideration. It is only in this way that a just decision concerning the merits of all projects can be reached.

In the East the presence of a surveying party in one's pasture is an immediate incentive to raise the valuation of the land. Property that is only able to yield sweet fern and boulders, to judge by returns for taxation, finds itself lifted to the dignity of a choice corner on a city thoroughfare, as soon as the presence of a few surveyors indicates that a railway may run that way. Out in the West a belief has grown up in the same fashion in the minds of the people that because a survey has been made the government is committed to construction. Although the engineers always give warning that the surveys are to secure information and in most cases will probably have no result in the way of reservoirs and canals, it is proving a difficult task to convince people that they are not entitled to immediate construction as soon as the survey terminates. Sometimes these demands for construction become almost hysterical. The situation has a serious side because too frequently the warning of the government employes is disregarded, ditches and crops are neglected and when the expected relief fails to come there is loud complaint that the people have been deceived and promises have not been fulfilled.

So far as the Reclamation Service contracts are concerned, the situation is equally unfortunate. The financial soundness of the government is so manifest that a government contract has a dangerous fascination for many people who do not appreciate that the government is the hardest kind of a taskmaster in such work, requiring its pound of flesh from everybody with whom it has dealings. These people forget that an employe of the government cannot modify a contract, no matter how onerous its terms may be, and that their property and that of their friends who have gone on their bonds must be taken by the government in default of the work. Although these facts are told to the inexperienced men who wish to take contracts, they still come forward in increasing numbers and take work at prices which cannot possibly pay their expenses, let alone give a profit.

Much of the Reclamation Service work is of a new nature to many contractors who are thinking of bidding on it. On the other hand, many of the engineers of the service have spent a large part of their lives on irrigation undertakings and know pretty closely what they cost. There is no desire on the part of any of them to let a contract at less than a fair rate with reasonable profit, and they frequently warn low bidders against the danger they run. They know it is far better for all concerned that the contractor make fair wages for his men and a return on the capital he invests. The government representatives look with apprehension on the great increase in the number of inexperienced contractors who are endeavoring to secure contracts by putting in bids at ridiculously low figures. For the good of these men as well as the government itself the strongest emphasis should be laid on the fact that the contracts are carefully guarded and no discretion or leniency is possible after they are signed.

Heating Guarantees and Zero Weather.

There is nothing new in the discussion of heating guarantees and zero weather that is now taking place among those interested in such work. Nearly twelve years ago Mr. W. H. Francis, of Philadelphia, made a vigorous public protest against the usual terms, at that time, of the guarantee of a steam or hot-water heating installation. This ordinarily required the building to be heated to a temperature of 70° when the external temperature is at zero, the final payment being dependent on a practical demonstration. The impropriety and unfairness of this form of contract was pointed out in numerous letters to this journal, and cases were cited where the final payment was withheld for several years until zero weather occurred. This journal has steadily maintained the position that the practice is unfortunately too general among architects of throwing the arrangement of all the details of a heating installation on the bidders, specifying only that the building "shall be heated to 70° Fahr. in zero weather." This disposition to shirk responsibility on the part of the architects, and the readiness of bidders to take contracts on any terms and to gamble on the chances of being held to a strict construction of their requirements, are together clearly responsible for the reappearance of this unfair requirement at the present time. In view of what was accomplished over ten years ago, however, it would seem that any contractor who undertakes heating work for which any portion of the contract price may be retained until Providence sends zero weather, so that a practical test may be made, deserves no sympathy if his money is withheld for a period of several years.

If a heating contract is to be made with a contractor to whom the client is willing to give the work without competition, and the sufficiency of the plant is to be left to the contractor's judgment, then the guarantee for results may be expressed in the following terms: "The system shall be capable of maintaining a temperature of 70° Fahr. with the external temperature at ——," but the payments should be made when the work is installed and the guarantee relied on. When, however, as is more often the case, competition is desired, detailed plans and specifications should be submitted for all to bid on. If the architect is not competent to prepare these, experts should be employed. These plans and specifications should state the kind, character and size of boiler, size of chimney and size of grate. If the work is to be on the indirect system they should include the size of both heat and vent flues, the amount of indirect radiating surface, whether in coils or radiators, how this surface is enclosed, the size of the mains and returns, the number and quality of valves, a description of the fan and its supports, the shape and size of engine or motor, and those minor details which have a decided effect on the cost of the installation.

When this subject was discussed in The Engineering twelve years ago, a journal devoted to the artistic features of architecture, it claimed that the determination of the necessary boiler capacity and radiating surface is necessarily more a matter of inference than are the other technical details of building construction. This opinion, which is doubtless held by a good many architects, is not correct. Architects who have not the special technical knowledge requisite to prepare a proper heating specification, know perfectly well that such specifications can be secured the same as any other professional service. A heating and ventilating system must be designed to secure certain results under given conditions. These are best known by the designer of the building. The margin or factor of safety for which the owner must pay should be determined by his professional adviser, just as is done in the case of the beams and columns, and there is no more uncertainty in determining the requirements for heating apparatus than for other parts of the building.

With regard to competitive plans from contractors, this is shirking responsibility and often results in a number of the bidders estimating on poor work, whatever their proposals may nominally assert. Usually there is no expert to advise the owner what proposition is best for him to accept, and the cheapest is accordingly selected. While the owner may get all he pays for, he rarely obtains what he needs, which he finds out when the knowledge comes too late to be of value. In such an undertaking as the heating and light plant for the Congressional Library and office buildings in Washington, a number of contractors, in furnishing without compensation professional services in the shape of plans in the hope of getting the work, have largely increased their cost of doing business and reduced their legitimate profits, since competitive schemes are likely to be cut down to the lowest possible limit in order to keep the bids down. Such a competition must be regarded as a retrogression in engineering practice.

Thick Fires.

It is the prevailing opinion of some owners of power plants that it is necessary, when a boiler is worked at a high rate, to maintain correspondingly heavy fires. It is argued that thin fires are well enough for slow rates of combustion, but as the call for steam increases it must be met by an increased thickness of the bed of coal on the grate. Where heavy fires are carried it is a common thing for the fireman to shovel in all the coal he can conveniently supply, going so far as nearly to fill the opening at the firedoor, leaving little if any room for a future supply until that already in has been pushed back to make room for more. The ordinary fireman is likely to favor this method for the reason that he can introduce large quantities at a firing, and afterwards he is not obliged to give the fires much attention for perhaps an hour's time, when he will again fill the furnace full in the same manner as before. This method of firing with most of the high-class bituminous coals in use in the Eastern States requires from time to time the use of the slice bar for breaking up the bed of coal. Whatever necessity there may be, according to the popular idea, for carrying heavy fires, so far as the amount of work involved is concerned, it is really more laborious for the fireman than it would be to keep the fires comparatively thin and supply small quantities of coal at each firing. An explanation of the favor which this method receives may be that the class of labor generally employed for firing considers the muscular effort required much less of a task than the more frequent and careful attention which is required when the fires are kept at medium thickness.

So far as the engineering merits of thick and thin fires are concerned, the fact is more capacity can be obtained from a boiler when a fire of medium thickness is carried and proper attention is given to its condition, than can be realized by any system of management when the fires are exceedingly heavy. Advocates of thick fires, who take the ground that they are a necessity when boilers are forced, are entirely mistaken. As to the economy of the two, some persons maintain that heavy fires give the more economical results, but this is questionable. Valuable information on this point is afforded by two evaporative tests made by Mr. George H. Barrus. They were made on a 72-in. return tubular boiler having 100 3½-in. tubes 17 ft. long. The heating surface amounted to 1,642 sq. ft. and the grate surface to 36 sq. ft., the ratio of the two being 45.6 to 1. On the thick fire test the depth of the coal on the grate varied from 8 to 20 in., being heaviest at the rear end and lightest at the front end. On the thin fire test the depth was maintained uniformly at about 6 in. The coal used was New River semi-bituminous. The tests showed that the increased evaporation due to thin fires amounted to 11.5 per cent.

This result, which can probably be duplicated by tests of the same character made by other engineers, shows forcibly the importance of attention to boiler room management. A salesman who told a story of improving the economy of a whole boiler plant ten per cent. would probably be ranked as a gifted prevaricator. The change in conditions of firing effected such a result in this case, and The Engineering Record is firmly of the opinion that there are many plants in this country where the fuel bills could be cut down materially by careful attention to such matters. Owners of plants pay large sums for expensive equipment and then leave the most important part of the management, the firing of the coal, to the poorest paid and generally the least careful employees. The boiler room is the most vital part of a steam plant, and its management deserves careful, continuous supervision by somebody who understands the way to get the best service from the fuel.

Investigations of Traction on Roads.

The amount of literature devoted to the improvement of common roads which has appeared during the past few years is a sufficient earnest of the importance of the subject to the community at large, as well as of the interest which that community takes in the matter. Conventions and other organized meetings, together with the persistent and well-directed work of many individuals prominent in the movement evidence the fact that there is no lack of lay effort, which, fortunately, is bearing excellent fruit. Civil engineers, also, have responded efficiently to the demands for good road construction, so that probably no better roads could be built with the materials available and under the existing conditions than can be found in some portions of the country. But after all is said, and even in view of the facts that the enhancement of the value of real estate and the economy of improved facilities in highway transportation have been given due prominence, it is unquestionably true that quantitative data as to the economy of improved roads are yet lamentably scarce. This is a matter so largely civil engineering in character that it naturally would not receive first attention in the broad consideration of the subject by the public; yet it may almost, if not quite, be said to lie at the very foundation of the whole business. At any rate, if the greatest economy of transportation be reached, it will be found that the greatest degree of improvement has been attained.

The securing of quantitative data concerning the economy of improved roads involves the whole question of traction not only as it touches the determination of the forces required to move given loads on the various classes of road surfaces, such as dirt roads, macadam and asphalt, both on levels and grades, but also as it bears on the improvement of vehicles. The results given by the old authorities Morin and Navier, and by others, are well known to be anything but satisfactory when applied to the conditions of to-day, and, while there are some isolated later determinations of more or less value, the field yet lacks complete and systematic working. There is probably no way at the present time in which the cause of good roads can be so strongly fortified or efficiently advanced as by a comprehensive and thorough system of traction tests on all conditions of both improved and unimproved roads, on levels and grades, so conducted as to exhibit clearly and conclusively the effects of improvements and of various conditions of maintenance. There can be no argument so convincing to the average member of the country community as a clear-cut contrast between the small load laboriously hauled over the ordinary unimproved highway and the much larger load (perhaps five or six times as heavy as the former) smoothly transported with less effort over the improved road surface. This is really the kernel of the whole matter on which the development of all the arguments for good roads most largely depends. It is much to be desired that parties who are interested in this question should institute and carry out under competent engineering supervision such an investigation as that which we have outlined above. It would not be an undertaking of great expense, but the results would be of the greatest value in themselves and they would give added value to those of a fragmentary character which have already been made.

In view of these considerations it is particularly gratifying to observe that the Iowa Highway Commission has given this matter attention of the right kind. There will be found in some of its recent publications the results of unusually comprehensive tests, which are thoroughly convincing as to the advantages of an improved road surface and they most pointedly emphasize the need of complete and thorough investigations of these traction matters which affect or are affected by improved roads.

Leakage of Steam Plants.

Waste of steam by leakage is a thing which may be expected in all steam plants, but it is too apt to attain excessive proportions where it is believed to be trifling. Although attention has often been called to the matter in these columns, its importance cannot be too forcibly reiterated. Excellent engine performance may be secured by providing the required economical type of construction, and the highest economy in the generation of steam is obtainable by careful attention to the best principles of combustion and operation of boilers; but the consumption of coal is sure to be greater than it ought to be if some of the steam escapes from the plant by leakage, either from the boilers themselves, the piping or stop valves, or by passage through leaking valves and pistons in the engine cylinders. This very thing is one of the greatest objections to the use of high pressures, and it is in plants where high pressures are in vogue that the utmost vigilance should be exercised in this important matter. An instance may be referred to where leakage was going on to an excessive degree when it was least suspected. An excellent arrangement of steam piping was provided, in which all the water of condensation found its way by gravity to one low point, where a separator was applied, the drain pipe of which led through a trap to an open exhaust steam heater. The steam trap, influenced by the action of the pressure, which in this case was extremely high, failed to work efficiently, and it allowed a continuous escape of steam unchecked and, with the arrangement of discharge noted, undetected. The loss of steam at this one point was far in excess of any saving resulting from the high pressure which was carried, and vitiated the economy of a plant which would otherwise have been unexcelled.

It would well repay the engineman in charge of a power plant if a thorough examination were made for leakage at regular intervals of say once a month. It is an easy matter to determine the amount of leakage from the boilers and steam piping by observing the fall of water in the gauge glasses when the engine is stopped, and the usual steam pressure maintained. If there is no loss the full height of water should be maintained continuously, or with practically no reduction. On the same occasion the valves and pistons of the engine should also be examined for leakage, which can easily be tried by the indicator cock test, so far as this applies, and by the time method when the other is unavailable. With systematic attention to these matters loss of steam by leakage could not go on unawares for a great length of time, and when found the proper remedy could be applied for its prevention.

Notes and Comments.

THE ILLINOIS TELEPHONE TUNNEL in Chicago was connected with a railroad last week for the first time, when shafts from it to the tracks of the Chicago & Alton R. R. were opened. Several cars of coal from the railroad were delivered to a downtown business house through the tunnel, and all of the coal traffic from this road intended for the downtown district will be delivered in this manner in the future.

INSTRUCTION IN APPLIED SCIENCE has become so attractive at Yale University that the Sheffield Scientific School now has more students in its incoming class than the college proper, the numbers being 410 and 396, respectively. The school now has nine buildings arranged around its own campus, and its courses of instruction in scientific subjects are so complete that there is some discussion concerning the necessity of maintaining another corps of instructors in the academic department for the same work.

THE ELASTIC CURVE of a simple or continuous beam can be constructed graphically by the following method, devised by Prof. M. S. Ketchum: Construct the bending moment polygon for the given loading on the beam. Load the beam with this bending moment polygon, and with a force polygon having a pole distance equal to $E\,I$ construct an equilibrium polygon. This polygon will be the elastic curve of the beam. It is not commonly convenient to use a pole distance equal to $E\,I$, so one equal to $E\,I \div N$ is employed, the deflection at any point being the quotient of the measured ordinate divided by N.

THE VOLATILE MATTER in coal was discussed at some length by Prof. S. W. Parr at the recent annual meeting of the Illinois State Electric Association. He dwelt particularly on the fact that all volatile matter is not combustible. Although the incombustible portion in high-grade eastern coal, such as Pocahontas, is very small, it is high in the output of the Illinois collieries. While 104 to 109 lb. of Pocahontas coal will give 100 lb. of combustible, it requires 119 to 141 lb. of Illinois coal and 120 to 162 lb. of lignite to secure that yield. The effect of this difference on the steaming capacity of a boiler was very marked. The non-combustible volatile matter passes off as steam.

THE FIRE PROTECTION RESPONSIBILITY of a private water company was recently before the Ohio Supreme Court in Blunk v. Dennison Water Supply Co., 73 N. E. Rep. 210. The court's syllabus of its decision is as follows: "The owner of property which is destroyed by fire through the failure of a water company to furnish water and fire apparatus to the municipality in which it is situated and to the inhabitants thereof in accordance with its contract with the municipality, cannot maintain an action against the company to recover the damages resulting therefrom. There being no legal obligation resting on the municipality to afford him protection against fire, he is not privy to the contract by substitution."

AN ELECTRIC SUB-STATION AND GARDEN is an innovation by one of the lighting companies of London, Eng. Being compelled to locate a sub-station in a very congested district an arrangement was made for the use of the private garden of the Duke of Westminster, with the proviso that it be not disturbed. Accordingly the station is a low structure with the garden on top of it. The garden, or roof level, is 8 ft. above the street, and is laid out with walks, flower beds, potted trees, fountains, etc., while the machinery room below has ample headroom with good ventilation and daylight lighting. There is, to judge from a street view of the structure, no suggestion as to its purpose.

A SINGLE-PHASE RAILWAY for both passengers and freight has recently been opened between Atlanta and Marietta. The cars run over street tracks in Atlanta, and elsewhere on a private right-of-way, where 70-lb. rails and slag ballast are used. The maximum grade is 3 per cent., and the sharpest curve has a radius of 574 ft. The double-track cars weigh 30 tons each and seat 56 persons. They are equipped with quadruple Westinghouse motors. The trolley voltage in the city is 550 and elsewhere 2,200, and a single 0000 trolley wire forms the entire distributing system. The passenger cars run only on tracks having the alternating current, but the freight cars are run over the city railway with both kinds of current.

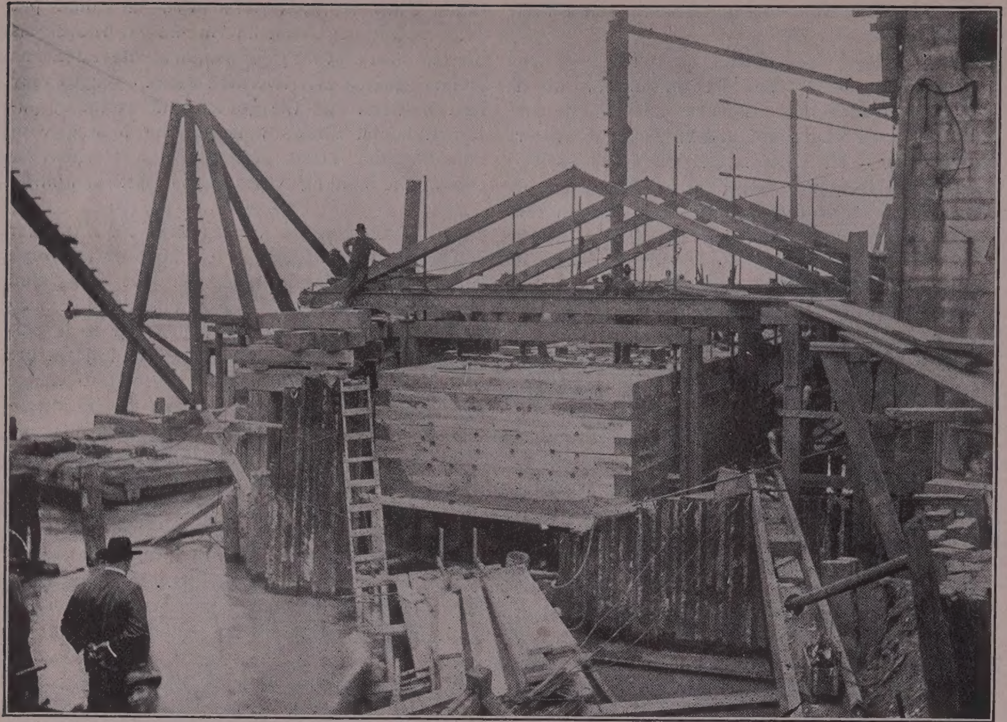
CENTRIFUGAL PUMP TESTS are being made on a large scale under the direction of Prof. D. W. Mead in the new hydraulic laboratory of the University of Wisconsin. A specially-designed 1,000,000-gal. centrifugal pump, which is fitted so a wide range of types of impellers may be used in it, has been built for this work, and will be run at various rates of speed up to 3,000 r.p.m., or possibly higher. Extensive experiments will also be made on full-sized apparatus to determine the effect of gates, submerged orifices and screen racks on the flow through intakes and similar waterways. Patented apparatus that is offered will also be tested. Bulletins giving the results of these tests and experiments will be published by the University. The new laboratory, 48x96 ft. in plan, has two stories and a basement and is very favorably located for carrying on large scale experiments.

A BUILDING FAILURE from the usual cause took place in Buffalo not long ago, killing one man and injuring several more. It was investigated by the Deputy Building Commissioner, who found that it was due to wretched masonry under a cast-iron column. This column supported a brick chimney and a part of the floor loads of the second and third stories. The pier supporting this column was "simply veneered with apparently fair-sized stone and the center filled with small stone and spawls, not slushed in full with mortar." Such an accident in Prussia would put the mason in prison for a term and out of business for all time. Trifling with human life for a few dollars' gain is not tolerated there. Wages may be low there, and the government decidedly paternal, but it allows none of the fooling with humanity that is characteristic of a considerable part of the building operations in American cities.

THE TELAUTOGRAPH is now used for a number of purposes for which the telephone or telegraph has previously been in service. At the Union Terminal Station in St. Louis and the Pittsburg Terminal of the Pennsylvania R. R. it is employed in announcing the arrival and departure of trains. A number of banks use it to enable the paying teller to ascertain from the bookkeeping department the condition of a depositor's balance. The Philadelphia Electric Co. has a line used mainly for sending meter readings to the bookkeeping department. A number of large business houses employ it to enable the bookkeeping department to furnish information quietly concerning customers' credits. It is employed in fortifications in sending information from position-finding stations to the gunners.

A CUT-OFF WITH LOW GRADES is being constructed from the St. Louis division to the Kansas City division of the Chicago & Alton R. R., just south of Springfield, Ill., which will shorten the distance between Chicago and Kansas City 5 miles and eliminate heavy grades north of the junction between the cut-off and the latter division. The cut-off is 35 miles long, and is entirely on tangent, the connecting curves at its extreme ends being the only curvature introduced. It is being built primarily for freight traffic and has a maximum grade of 0.3 per cent.; the maximum grade on the St. Louis division between the junction with the cutoff and Chicago is also 0.3 per cent. There are a few short cuts on the new line, but it is practically all on fill, and although only one track is to be laid at once, an 18-ft. berme is being left for a second track. The smaller drainage openings are cast-iron pipe, the larger ones being concrete arches. Several highway crossings are carried under grade through concrete arches, and the tracks of two other railroads are crossed on bridges. The work is under the immediate direction of Mr. G. H. Hailey, assistant engineer, who states it is to be finished early next season.

THE HISTORY OF EARLY ENGINES has been amplified by discoveries recently made by "The Engineer," of London. The oldest known print of a steam engine is in the Birmingham Public Library and shows a machine built in 1712 by Savery and Newcomen. A search made by the journal mentioned has brought to light an old engraving dated 1725 and entitled "The Engine for Raising Water by Fire." It is unique in containing the first illustrated description of a steam engine. This machine is somewhat different from that portrayed in the earlier engraving, for the boiler is fed with a portion of the hot water coming from the bottom of the cylinder or hotwell. This fixes the date of the improvement described by Desaguliers in his "Experimental Philosophy" as follows: "It had been found of benefit to feed the boiler with warm water coming from the top of the piston rather than cold water, which would too much check the boiling, and cause more fire to be needful. But after the engine had been placed some years, some persons concerned about an engine observing that the injected water as it came out of the induction pipe was scalding hot, when the water coming from the top of the piston was but just lukewarm, thought it would be of great advantage to feed from the eduction or injected water, and accordingly did it, which gave a stroke or two of advantage to the engine."



Building Caisson in Cradle Suspended from Trusses.

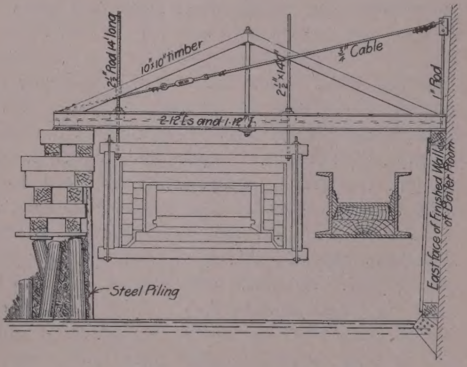
COALING TOWER FOUNDATIONS OF THE UNION ELECTRIC LIGHT & POWER CO., ST. LOUIS.

The foundations of the big 60,000-kw. power station of the Union Electric Light & Power Co., of St. Louis, Mo., rest on bed rock on the shore of the Mississippi River. The building of these foundations has been one of the most vexing engineering problems, perhaps, that has been undertaken in connection with power house work for some time, owing principally to the nature of the ground and depth of water encountered.

This work was started in the summer of 1901, when one of the largest, if not the largest, sheet steel pile cofferdams ever constructed was driven (approximately 350 ft. in length by 150 ft. in width) and the work of excavation behind the walls of this dam was begun for a site for the walls of the power station. In driving the sheet piling difficulty was experienced in getting the piling to rock, as the site was largely filled ground. A few old barges and the hull of an old steamboat were dug out a few feet below the surface, besides innumerable boulders from the size of a man's head up to stones containing half a yard or more.

The foundation walls of the building proper were put in without much difficulty as the bed rock cropped up only a few feet below the surface. However, outside of the east and river side wall of the building another wall was designed to connect with the east wall of the building and carry a railroad track on 24-in. I-beams connecting the tops of these two walls so that cars loaded with coal, cinders, etc., could be handled at this side of the building. This wall was also designed to strengthen the east wall of the building against the high water of the Mississippi River and the two walls were to be connected with 24-in. I-beams at three points, viz.: the top, about 20 ft. below the top, and at a point a few feet above low water. This outside wall was to start on bed rock and extend up for a distance of 70 ft., being 12 ft. wide on the bottom and 3 ft. wide on the top with a batter on each side. The wall is strengthened by steel A-frames 6 ft. apart, set in the concrete, running the whole height of the wall. These A-frames in turn are connected together every few feet in height with 2-in. square steel rods. The walls are all concrete, molded around the A-frames and bars.

The space between the east wall of the building and this outer wall (about 35 ft. at low water) is to be utilized as an intake chamber for the circulating water used for condensing purposes. The north or upstream end of this outer wall was also intended for a foundation for a coaling tower. The coal to be taken from barges in the river and elevated by means of this tower to the coal bunkers which are situated at the top of the building. The site of this outer wall was in the river proper. From low water to bed rock is 25 ft. As low water occurs for a short time only, however, there was ordinarily a head of 35 ft. to 50 ft. of water to contend with outside of the cofferdam.



Temporary Support of Caisson.

No difficulty worth mentioning was experienced in excavating for the first few feet, but as the excavation progressed in depth, the water came in faster than it could be handled by the pumps, a large number of which were in use varying in size from 4 in. to 12 in. and all of the centrifugal type. The cofferdam was, when driven, divided off into a number of compartments by transverse lines of steel sheet piling at intervals of a few feet. Each compartment was then excavated to bed rock and the wall was built in it before another compartment was pumped. In this way, after a series of vexatious delays, about 150 ft. of the wall was constructed at the south end, there being 325 ft. in all in length.

The south 150 ft. of the cofferdam did not leak from the fact that the piling was correctly driven. The closing of the dam was at the north end of the cofferdam. The spacing of the piling was so inaccurately calculated that the last piling driven did not come to within 2 ft. 6 in. of closing at the top and 18 in. at the bottom. No wales or guides of any kind were used in the driving, the piling being driven, hit or miss until a V-shaped opening was left at the last joint. This was the point where all the trouble occurred. Ordinary square 12x12-in. timbers were driven vertically between the adjoining edges of the sheet piling, leaving a V-shaped opening within 10 ft. of the bottom of the piling, which let in enough water to keep a number of large size pumps going. Attempts were made to close this opening by the freezing process, but failed.

The pile driver hammer only weighed 2,200 lb., where it should have weighed 3,500 lb. The piling never allowed any water to pass through it, but in compartment No. 1, which was the north bulkhead section, the closing of the dam was improperly done, and in consequence a leak was formed that no pump could hold down. Wherever the piling was properly driven the water was excluded and no leaks occurred. The piling used for this section was the lightest made; too light, in fact, for the length employed. No fault was ever found with the piling itself. It was improperly driven and no particular attention was paid to the closing of the last section. Had the last section been properly closed, all trouble experienced would have been avoided. At no time has there ever been any complaint with regard to the Friestedt piling; fault was found with the driving only.

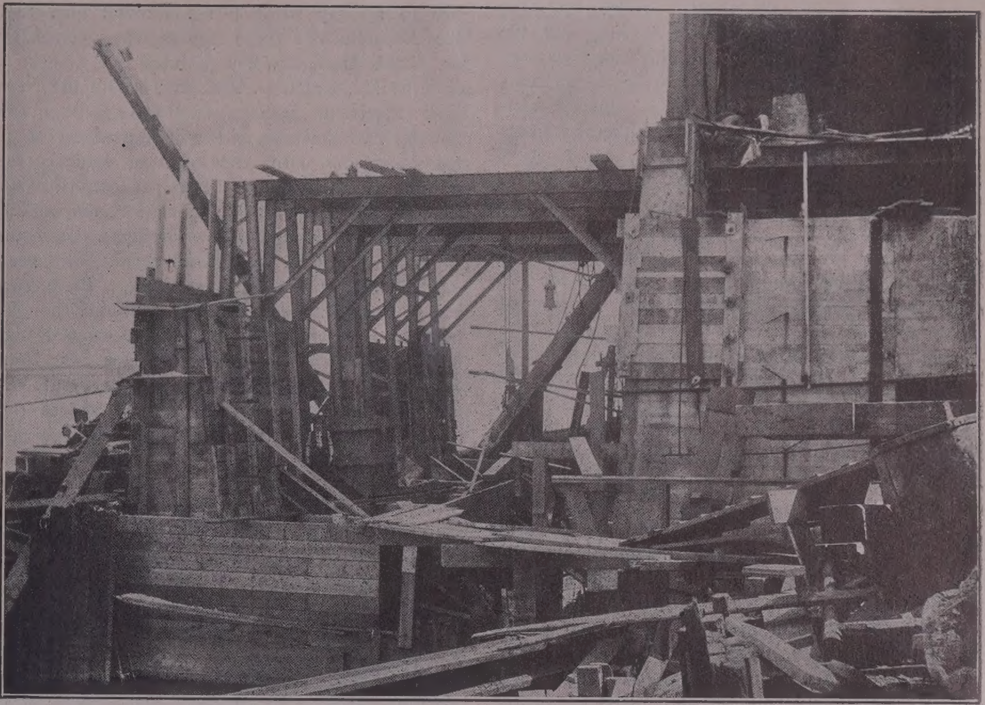
At the north end of the cofferdam more trouble was experienced. Here the cofferdam was also divided by bulkheads into compartments, but it was found impossible to pump the water low enough to excavate to bed rock and start the concrete foundation wall. In a great many instances the steel sheet piles were found to have struck obstructions, such as boulders, logs, etc., before they reached the bed rock. On striking such obstacles the sheet pile was invariably deflected to one side. This left a chance for the soft Mississippi River silt to break in underneath the pile, followed, of course, by a deluge of water greater than the combined power of the pumps could handle. The cofferdam process at this point was accordingly abandoned and a system of pipes were driven and the freezing process tried. A cooling liquid, obtained from a nearby cold storage station, was circulated through the driven pipes for several weeks without any results being obtained. This process was also discarded as unsuccessful. The water was then pumped as low as possible in the dam and a second dam of Wakefield wooden sheet piling was driven inside of the steel sheet pile dam around where the worst leaks developed. Another attempt was then made to pump out the dam, but this was unsuccessful.

The Foundation Co., of New York, was called in consultation and advised a wooden pneumatic caisson on top of which would be carried the section of outer wall necessary for the foundation of the coaling tower. The wall at this point was designed to contain spaces for the intake gates and screens for the admission of the Mississippi River water through the wall. Arrangements were entered into with the Foundation Co., in March, to sink the caisson as recommended and designed by it.

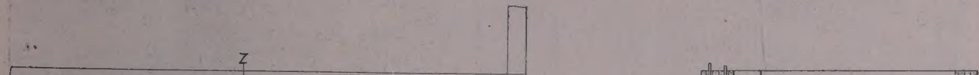
The site of the proposed foundation was greatly obstructed by braces and a section of the wooden cofferdam. These were removed, before the caisson was built, by a diver attaching a chain from the falls of a derrick which afterwards pulled out the braces and other timbers. Some of the wooden sheet piling had to be shattered with dynamite before it could be removed.

The caisson had to be built in place inside the steel sheet pile cofferdam. Four king-post trusses 50 ft. long were stretched from the top of the steel dam across to a bent of timber supported on an offset of the east wall of the building. From these trusses four cradles made of 12x12-in. yellow pine timber were suspended. The cradles were very strongly built and each one was circled with a band of 1¼-in. round iron. In these cradles the bottom section of the caisson up to 8 ft. high was built. The cradles were then lowered simultaneously from the trusses with eight 3-in. steel screw rods until the caisson floated in the water by its own buoyancy. The cradles were then removed and cribbing built on top of the caisson. Concrete was placed in the crib until it was 8 ft. high.

This caisson was constructed of 12x12-in. yellow pine timber with side and end walls 18 in. thick and a deck 2 ft. thick with an over-all dimension of 50 ft. 6 in. in length by 17 ft. 6 in. in width, with a working chamber 7 ft. high. The walls were beveled at the bottom to form a 6-in. cutting edge. Eight feet of concrete was all that could be deposited inside of the cribbing until the caisson was landed on final bottom. As the bottom of the lower intake gates and passages began at this elevation, and also the bottom of the steel A-frames which were set in the concrete wall to strengthen it, it was not deemed advisable to erect this steelwork until the caisson was landed, as there might be a difficulty in connecting the different members should the caisson land out of exact position. Therefore pig iron was put in on top of the 8-ft. block of concrete for weight. Air was then turned on and sinking operations began, more pig iron being added from time to time as needed for weight. Before lowering the caisson into the water the excavation was leveled up with bags of mud, so that the caisson came to an even bearing before air was put on.



Moulds and Reinforcement for Concrete Wall.



Views of Pier with Caisson and Sheet Piling.

The caisson went through about 10 ft. of mud before rock was encountered. The rock slopes off at an angle of 40 deg. from the west side of the caisson to the east side. The rock on the west side was excavated for a depth of 13 ft. or until the caisson rested on a perfectly level rock bottom. This surface was washed and scrubbed with wire brooms. Equi-distant dowel holes were then drilled into it and thirty 1½-in. round steel dowel pins 3 ft. long inserted in the holes. The working chamber was then filled with concrete. The rock excavation was accomplished with two air drills. Small charges of dynamite being exploded in the drill holes, the rock, etc., was then removed by a bucket operating through the Moran lock.

The cribbing on the caisson consisted of courses of 12x12-in. yellow pine built up one on top of another 30 ft. high. This was sheeted on the outside with 3-in. plank, calked. On top of this cribbing was a removable cofferdam 15 ft. high to provide for a stage of water as high as might reasonably be anticipated at that season of the year. This cofferdam was of somewhat lighter construction than the cribbing. After the working chamber was filled with concrete, the crib was pumped out, braces being put in every few feet as pumping progressed until the water was entirely out of the cofferdam and the top of the 8-ft. block of concrete exposed to view.

No trouble was experienced in keeping this cofferdam dry with a 3-in. pulsometer working a few minutes each day. The intake gates and screens and the A-frames were now set on the concrete and the wall was carried up to the top where the column and girder details of the coal tower begin. Great care was taken to land the caisson in position and to maintain it level while sinking. This precaution was necessary as the space inside of the steel dam was almost completely occupied by the caisson and there was danger of it wedging and hanging up against the walls of the steel dam. Provision had to be made to pump against a possible very large head of water in case the river was as high as it usually is at this time of year. Luckily, however, the greatest head actually encountered was about 35 ft. Air was taken off the caisson May 16, 1905.

The work was done for the Union Electric Light & Power Co., Mr. W. V. N. Powelson, general manager, by The Foundation Co., Mr. George Adgate, M. Am. Soc. C. E., western manager. Mr. Fred W. Adgate, Asoc. M. Am. Soc. C̄. E., was the superintendent in active charge of the work.

A HYDRO-ELECTRIC INSTALLATION, with a generator capacity of 7,920 kw. has been in operation for nearly a year on the Cauvery River, in the province of Mysore, southern India. Power is transmitted at 35,000 volts over duplicate three-phase lines to the Kolar gold fields, 92 miles from the generating station, and used largely in mining operations. The river has a fall of nearly 400 ft. available at the station.

A Reinforced Concrete Bridge, Sorsogon, P. I.

By H. L. Stevens, Provincial Supervisor.

During the present year the Provincial Supervisor's office at Sorsogon has designed and constructed for that city a reinforced concrete arch bridge of 45 ft. span and 6 ft. rise. The bridge is 35 ft. wide, divided into a roadway 25 ft. wide and two sidewalks each 5 ft. in width. The new arch replaces an old Spanish bridge of three spans built, except for the arch ring and the facing, of lime concrete. The old bridge was too narrow for present traffic and the foundations were weak, a common fault of all Spanish construction, but the lime concrete of the abutments and arch filling showed excellent construction and required a considerable use of dynamite to break it up enough for the workmen to handle it to advantage.

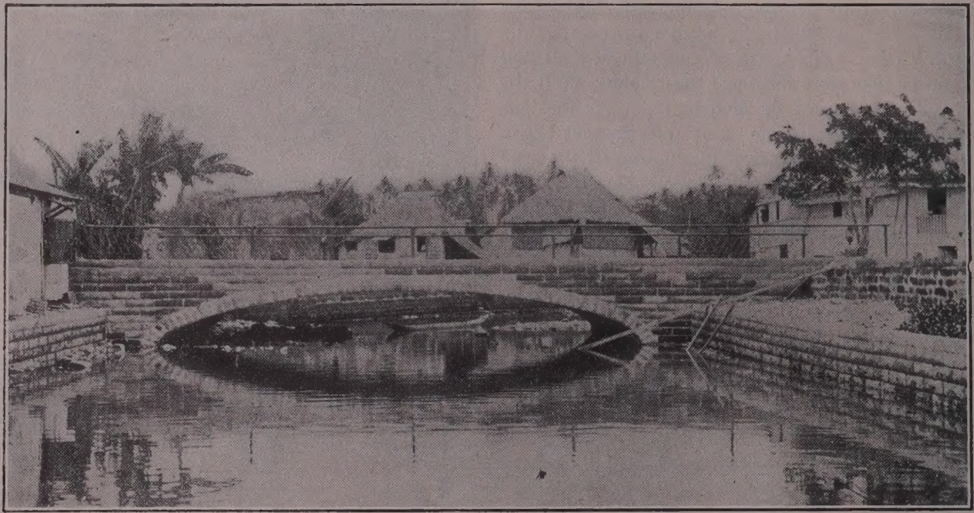
All labor was performed by native laborers under a native foreman. The concrete for the bridge was composed of cement and unscreened river gravel taken from the river bed at the bridge site, that for the abutments being mixed in the proportion of one to six and that for the arch ring having a ratio of one to five. The abutments rest upon gravel and the foundations are carried about 6 ft. below the river bed. The effective bearing area is nearly doubled by means of offsets.

Considerable concrete was saved by using in the abutments the cut stone that made up the facing and arch rings of the old bridge. The stone was carefully imbedded in the concrete, no two stones being allowed to touch each other, and the abutments were carried up as rubble concrete; this construction averaged one barrel of cement to one and one-half yards of rubble concrete in place.

The arch is elliptical in form and the ribs for the centers were made by cutting one full-size model and making the rest to match. These were then blocked up in place and 2-in. plank laid for lagging. The lagging was merely tacked in place and the nails withdrawn as the concreting progressed.

The reinforcement consisted of steel rods of various sizes and dimensions, the Manila market not being able to furnish a sufficient supply of any one kind. The reinforcement was built in place and the concrete, mixed fairly wet, carefully packed around it. For the work of concreting, the arch ring was divided into seven longitudinal sections each 5 ft. wide; by running a mixing gang on each end and working towards the center one ring could be completed in one day's time. The center sections were completed first. Before the outside sections were completed the facing of concrete blocks was built in place and the outside concrete rings then finished. As soon as a section of the arch was completed it was covered with gravel and kept wet for a week. The bridge was open for traffic as soon as the first four rings were completed. As soon as the arch was finished the railing was put into place and the sidewalks and curbs built.

The arch was completed on July 1 and on Aug. 1 the centers were taken out. No cracks appeared in the arch ring, the facing or the sidewalks above. The soffit of the arch is a reproduction of the grain and surface of the lagging boards; it had no holes or cracks and required no plastering. The bridge as completed, together with 500 ft. of retaining wall along the river, cost $4,000 and required 900 barrels of cement.



Reinforced Concrete Arch at Sorsogon, P. I.

A Garbage Incinerator, having a capacity of 150 tons in 24 hr., is being constructed by the Horsfall Destructor Co. in Zürich, Germany. The mechanical equipment of the destructor is electrically operated, a 500-kw., 3-phase alternator, direct-connected to a Brown-Boveri steam turbine supplying power.

A Discussion of Large Gas Engines.

Two important papers on large gas engines were recently read before the American Street and Interurban Railway Association, one by Mr. J. R. Bibbins on the application of gas power to electric railway service (Eng. Record, Sept. 30), and the other by Mr. Arthur West, on the design of large gas engines with special reference to railway work (Eng. Record, Oct. 14). The discussion of these papers was opened by Mr. C. O. Mailloux, who pointed out that in a paper by Mr. Ralph D. Mershon, before the New York Electrical Society diagrams were given showing that the lines of the comparative cost of steam and gas plants crossed at a value corresponding to a $2.00 or more per ton of coal. That meant for any value of coal corresponding to about $2.00 per ton, the two systems, the steam plant and gas plant, were about equal. This year Mr. Bibbins gives a diagram where these two lines cross at $1.00 per ton. Mr. Mailloux thought that was a very significant fact. It showed that the cost of the gas engine power must have been greatly reduced in some way. Either that has been brought about by reducing the cost of the machinery itself or the cost of its maintenance, or by increasing its efficiency, and it would be the most interesting feature of the entire paper, if Mr. Bibbins would give some clew as to the reasons which have brought about that result. Mr. Bibbins replied that he was not very familiar with the assumptions taken in the paper by Mr. Mershon, but assumed that he worked up his diagram for an electric lighting plant, in which the load factor on the system is barely 25 per cent., usually lower than that. Mr. Bibbins had taken a load factor corresponding to an average large railway plant, 66 per cent. That is really the greatest factor in determining the exact crossing of these two lines. He was not familiar with the prices which Mr. Mershon used in preparing his diagram. The costs he had used in the paper were quite recent. He had estimated the cost of operating, labor supplies and repairs at 0.5 cent per kilowatt-hour. In the absence of absolutely definite information he was obliged to take the same figure for both plants, but that it was very possible in the gas plant that these items might be lower than for steam plant. He desired to point out that the present cost of anthracite coal brings the anthracite producer well within the range of power plants generally. For instance, it is possible to obtain in Cleveland and Buffalo, which are comparatively central points, pea anthracite coal at $3.12 per ton; No. 1 buckwheat coal at $2.45 per ton, and No. 2 buckwheat coal at $2.00 per ton. Where plants are located in the bituminous field or adjacent thereto, there would, of course, be no question about the superior economy of bituminous plants.

Charles Hewitt, of Philadelphia, said that he well appreciated the difficulty of preparing diagrams such as accompanied Mr. Bibbins' paper, as he had attempted on several occasions to prepare similar diagrams. He was not prepared to question Mr. Bibbins' statement of cost for the gas plant, but the statement of the cost per kilowatt-hour for the steam plant seemed to him to be open to question. The steam plant indicated in the diagram is very uneconomical. Anthracite buckwheat coal runs between 11,000 and 12,000 heat units per pound of coal, while the diagram shows that this coal would run from 6.5 to 8 lb. per kilowatt-hour. The poorest plant with which he was personally familiar showed better results than that. He was familiar with plants running non-condensing which showed 4.5 lb. of coal from year's end to year's end. The consumption will run as low with good coal as 4¼ lb., seldom over 4¾ lb., and the average for the year will be 4.4 to 4.5 lb. Running condensing with the same quantity of coal, it is perfectly possible to run at 3.5 lb. of coal. Mr. Hewitt further said that the difference between the cost of operating the steam plant and the cost of operating the gas plant was magnified in Mr. Bibbins' diagram. Thus, with coal at $2.50 per ton, the diagram shows that the cost of operating the plant would be over 9 mills per kilowatt-hour. He was perfectly familiar with plants which are running at 6 mills with buckwheat anthracite coal, including all operating costs and repairs, but not the interest on the plant. It is a very uneconomic plant that will run the year through at 1 cent. So it seemed to him that if the diagram in question was intended to represent the average results throughout the whole country, it was very high for the steam end of it, and therefore magnified the difference between the two lines, assuming the cost for the gas plant was correct. He expressed himself as not being quite clear in regard to the table for operating costs for the London Metropolitan Boroughs.

Mr. Bibbins replied that he had been somewhat apprehensive that the diagram of the cost of steam and gas plants would be misunderstood, and therefore had taken pains to mention on the floor that it referred to a non-condensing steam plant. The equipment at St. Louis consisted of a three-cylinder vertical gas engine belted to a generator and an engine of similar capacity. It could not be expected to get the same economy out of these two plants as out of the large central station;

not from the fact that the equipments were not equally comparable, but that the results were obtained with a non-condensing plant. He thought it was safe to say that the relative coal consumption between steam and gas plants would be about two to one. In the present case the ratio is higher, as the steam station is non-condensing. He asked if that answered the question.

Mr. Mailloux inquired if Mr. Bibbins was able to give any information as to whether a change in the size of the plant would have any effect on the relative arrangements of these lines. Mr. Bibbins replied that that was a difficult question to answer definitely. There was one point which had a bearing on it, and that was the fact that a small gas engine will show an efficiency quite comparable with a large one, therefore the choice of the larger engine is determined mainly by the capacity necessary in the plant with such sized units as to obtain the highest running economy. He did not see any reason for the change in the relative costs of these various items in the smaller plants, provided the same number of units was used. The number of units, of course, has an immediate bearing on the operating cost.

Mr. Mailloux said he did not think the question had been fully answered. He had intended to add to his remarks that the question of cost of installation, it seemed to him, had quite an important bearing on the upper line of total costs, and he would presume that the smaller plant would have a much higher cost per kilowatt unit than the larger plant, as is found to be the case with steam plant, at least within certain limits. In the present connection he would also like to ask Mr. Bibbins to give information as to whether the cost per kilowatt of gas engines had not been considerably reduced within the last year. Mr. Bibbins replied that he agreed with Mr. Mailloux that the smaller plant would cost more per kilowatt, even though the same number of units were installed. At the same time the relative economy of the steam plant will increase much more rapidly with smaller units, and this fact might readily more than balance the increased capital cost of gas plant. The producer in smaller sizes is much more efficient than the boiler, and the same is true with the engine, although it is impossible to tell whether the same relation will hold. He did not think he was in position to give Mr. Mailloux any correct data as to whether the cost of gas engines had been reduced in the last year; that was something which was not directly in his field.

He had already mentioned the fact that the special type of generator for gas engine work was about to be introduced, which would place the engine and generator more nearly upon the same basis of rating, and, incidentally, reduce the cost of the complete unit. On the present basis of ratings the gas engine has a normal overload capacity of about 10 per cent., whereas, the generator can sustain a continuous overload of 25 per cent. within the normal temperature rise. Furthermore, on sudden overloads the capacity of the generator may be easily 50 per cent. above its normal rating, whereas, the overload capacity of the gas engine is limited, as has been previously pointed out. The two elements of the complete unit, engine and generator, can thus be brought more nearly to an equal basis of rating by discarding the 15 per cent. excess overload capacity of the generator, while still maintaining the present basis of temperature rise. This will simply result in a smaller generator, and, obviously, a reduction of its cost also.

Mr. Bibbins replied that the present basis for an overload capacity in the case of the gas engine was 10 per cent. It was possible to assign an overload capacity in the same way to the steam engine. As is normally the case, the steam engine is rated at such capacity as to give its best economy at about ¾ load. He had assumed the engine to give its best economy at this load. But if we rate the engine on the basis of 10 per cent. below its maximum the steam consumption would evidently be much higher, although the fixed cost would be considerably reduced. Mr. Marburg remarked that it would seem impossible to obtain a load factor of 66 per cent. if the overload capacity of the machine is so small. That is a good load factor for a reciprocating steam engine. Mr. Bibbins replied that load factor is a characteristic of a station service, not of the prime mover, so that the overload capacity of the gas engine is only an incidental factor.

Mr. Mailloux said that the point which Mr. Bibbins made, it seemed to him, was largely influenced by the form of steam motor used and its efficiency curve. One could see at once that it would be quite different in the case of steam turbines, which have a notoriously flat efficiency curve, and it seemed to him that if the comparison were made with the steam turbine it would be found in the first place that the line of cost for steam power would be much flatter for a smaller angle than it now is, and in the second place, the cross line would go further up. In the case of the comparison of the gas plant predicated as the basis of the calculations of the steam turbine plant, the line at which the two would cross would be more nearly at $2.00.

On suggestion of Mr. Mailloux, Mr. W. E. Winship was given the floor. Mr. Winship said he thought he could add a few figures on the gas engine plant that might be somewhat interesting. They had installed for the Gould Coupler Co., at Depew, N. Y., a gas engine plant consisting of three Westinghouse vertical engines rated at 235 h.p. each, with Loomis-Pettibone gas system. The plant cost almost exactly $115 per brake horse-power to install. They estimated that it would have cost $90 per horse-power for a steam plant, equivalent to the gas plant, excepting as regards coal consumption. In regard to the overload capacity, they figured that by installing a storage battery they could get the same overload capacity out of the plant. After the batteries are installed the plant will have cost about $130 per brake horse-power, and for the same overload capacity as the steam plant. Their coal consumption, based on coal containing 13,400 B. t. u. per pound, has been on a monthly average 2.26 lb. per kilowatt-hour on the switchboard, with a load factor on the plant of roughly 50 per cent. for 24 hours' operation. On a series of days when their load power was approximately 64 or 65 per cent., the coal consumption went down to 2.02 lb. as an average of the days when that condition existed. The lowest record for 24 hours' period of operation, when the load was especially good was 1.79 lb. of coal for a kilowatt-hour on the switchboard. That load is very similar to what is used in street railway work. The peaks, when the load is heavy, are fully 60 per cent. above the average, and when the peaks are lighter, they are fully 100 per cent. above the average load. The conclusions were that with coal at $2.30 per ton, and with the plant operated for about fourteen or sixteen hours a day, the steam plant and the gas plant would have just balanced each other, but that with the 24-hour operation the gas plant is more desirable. In regard to the reliability of the plant, he could state that it has been fully as reliable as any steam engine plant that could have been put in. They had only had the valves in the engines ground once, with the exception of one valve, which they ground twice. They used the splash lubrication.

Mr. Winship further said that there are two points worthy of attention in any gas engine installation. There is a criticism which could be made in regard to the ignition of the engines, especially where it is electric ignition. Some means should be provided for changing the igniters when the machine is in operation. The speaker did not know of any engine in which that is provided for. Another need is for some indicating instrument for determining roughly the heat contents of the gas. Of course, there are calorimeters by which the heat contents of the gas may be determined, but there is no rough and ready instrument to put in the gas producer house. The need for such an instrument is especially pronounced in bituminous gas plants where the color of the flame does not give any idea as to the heat contents of the gas. There ought to be such an instrument, and it did not seem to be a very difficult problem to design one.

Mr. Hewitt remarked that it might be of interest to some of the members to know the latest results in steam turbine plants which he had received only a few weeks ago from New England. As opposed to the 2.26 lb. of coal, which Mr. Winship gave as the average for thirty days, the results show 2.4 to 2.6 lb. per kilowatt-hour with bituminous coal. The average is 2.5 lb. for turbines as against 2¼ lb. for gas engines. One of these plants has five units of about 1,000 kw. each; the other has two units, and he thought in the latter case there were about 1,500 kw. using superheated steam.

Mr. Bibbins remarked that a comparison had been drawn between a 5,000-kw. turbine plant and a 450-kw. gas plant. He stated that in regard to changing the igniters, that a system is in vogue now which makes possible the changing of an igniter when the engine is running. In the high service pumping plant in Philadelphia each cylinder is equipped with an igniter plug, which has two contacts, and either one may be thrown in or out by a small switch. There are four independent sources of ignition current, and each cylinder is provided with a double set of igniters. If one of the igniters gets into trouble the other can be quickly cut in and prevent loss of power.

The Municipal Asphalt Plant in Montreal.

The city of Montreal, P. Q., has a municipal asphalt plant with a capacity of 1,000 sq. yd. of 2-in. topping per day, which has been in use for two years. According to recent statements by City Surveyor John R. Barlow, during the first two seasons there were 51,800 square yards of repairs and new work done by the city; the new work consisted chiefly of repaving streets formerly paved with three-inch tamarack blocks, which were worn out.

The average cost of the asphalt laid was $1.22 per square yard, and this figure includes all works in connection therewith. When the asphalting work is suspended on account of wet weather the old asphalt taken from the streets is ground in a mill and prepared for use in the construction of coal-tar composition sidewalks, so that no time is lost.

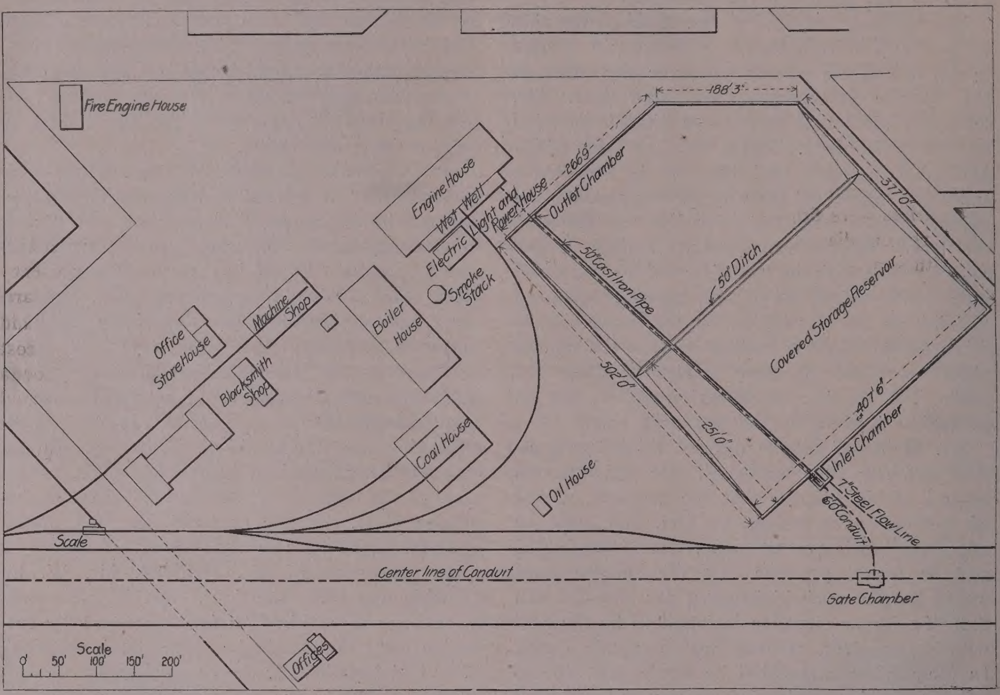
The city is this year making experiments with different brands of asphalt and hopes by next year to be in a position to determine which kind of asphalt is best suited to the conditions of our climate. It also hopes that it will thus be able to ascertain the exact area that a ton of each kind of asphalt will cover, together with the cost per square yard in each case.

The total cost of the civic asphalt plant, including buildings which have been erected in corporation yard, tools, repairs, etc., has been to date $22,881.35.

The approximate total area of pavements of all kinds in the city is 745,223.75 square yards, or thirty-three and one-third miles. Two-thirds of this is now under the city's charge for repairs, and the balance is still under guaranties, which expire yearly up to 1910.

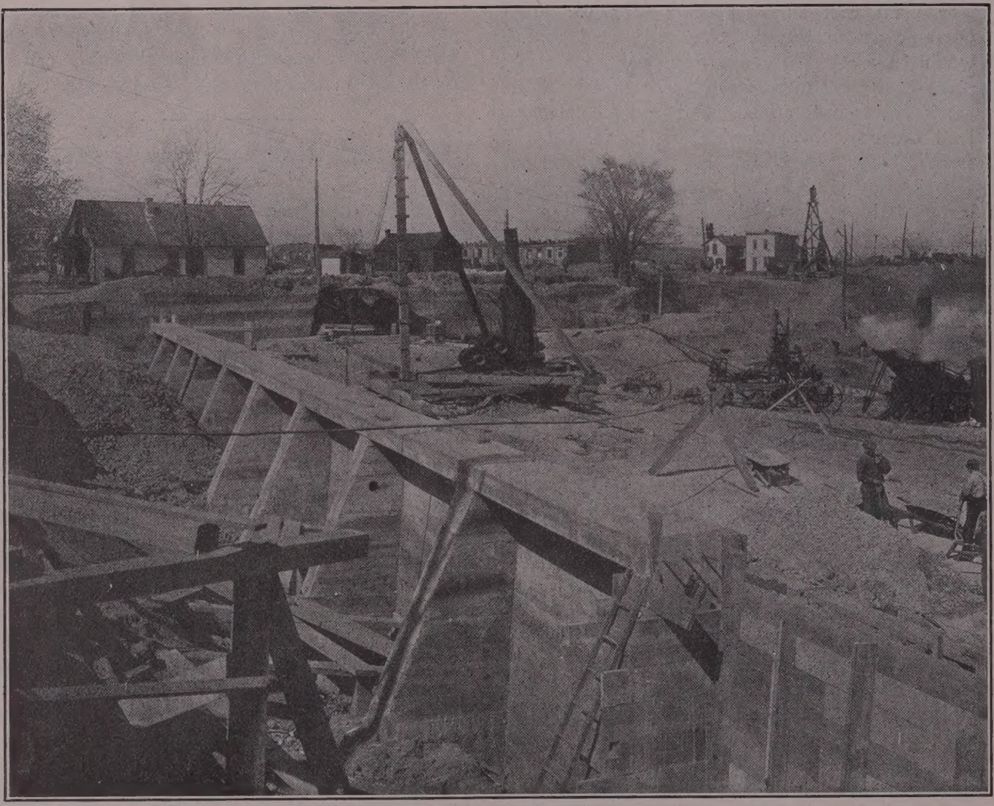
The Baden Reservoir of the St. Louis Water-Works.

In a number of respects the 25,000,000-gal. reservoir now approaching completion at the Baden pumping station of the St. Louis water works is an unusually interesting structure. It is being built in order to afford a storage capacity for the pumps at that place, which now receive their supply directly from a conduit running to settling basins at the Chain of Rocks, four miles away. The present arrangement necessitates the continuous use of the conduit, with no opportunity for examination or repairs so long as the high-service pumps at Baden are in service. The station pumps from 50,000,000 to 60,000,000 gal. daily, delivering it at 125 lb. pressure. With the new reservoir completed and in use, it will be possible not only to drain the conduit for examination, but also to have more freedom in handling the pumps and basins at the Chain of Rocks. The pumping at the latter place will not have to be varied with the changes in the water consumption, as is now the case, often requiring the stopping and starting of extra pumps half a dozen times in 24 hours. The Baden reservoir and the Chain of Rocks basins will also be connected by a 7-ft. steel flow line. The basin is 407½x502 ft. in size, measured on the inside edge of the coping. The 5-ft. cast-iron conduit from the Chain of Rocks basins is carried through it on concrete pedestals, which are so well shown in one of the accompanying cuts that no description of them is needed.



Arrangement of Buildings and Reservoir, Baden Pumping Station.

The reservoir walls are of reinforced concrete, of a cross-section first employed by Mr. A. O. Cunningham, chief engineer of the Wabash R. R., for bridge abutments at Monticello, Ill. Similar abutments used on the new Forest Park bridge of that railroad in St. Louis were illustrated in this journal on Nov. 5 of last year. The wall is 24 ft. high from the base of the footing to the top of the coping. The footing is 15 ft. wide and 18 in. thick, the coping is 39 in. wide and 1 ft. thick, and the wall proper is 1 ft. thick at the top and 2½ ft. where it begins to widen out at the bottom. The buttresses are 15 ft. 9 in. apart on centers, and are 2 ft. thick. The reinforcement is arranged as shown in the drawings, which are so complete as to render detailed description unnecessary. The walls are backed with 18 in. of puddle.



A Section of the Completed Wall.

The floor of the reservoir consists of 9 in. of concrete on 18 in. of puddle. The concrete will be laid in blocks about 7 ft. square, with ½-in. joints filled with asphaltic cement. The floors drain to a ditch in the center, which empties into a sewer through a 20-in. pipe passing through the bottom of one of the walls. In case the basin is drained, the 5-ft. pipe line will furnish a supply to the pumps.

The inlet chamber is arranged so that the basin may be filled from the present conduit, from the 84-in. steel flow line, or from both, and the water may also be turned from the flow line into the conduit for delivery below the Baden station, thus cutting the upper end of the present conduit out of service at will.

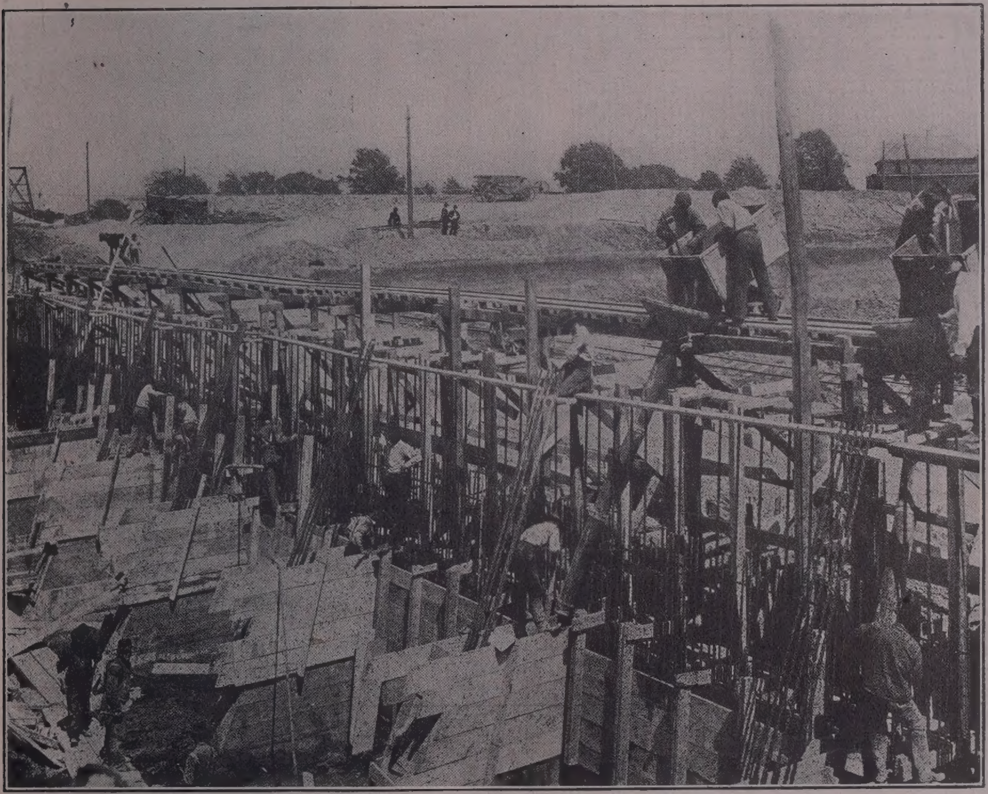
The contract for the reservoir was let to the Gilsonite Construction Co., of St. Louis, in July, 1904, for $232,809.50, and the work will be finished early next year. The total excavation will amount to about 200,000 cu. yd., of which almost 20,000 cu. yd. will be solid rock. The excavation was at first carried on by grading machines loading wagons, and later by a steam shovel loading cars. The walls will contain about 6,000 cu. yd. of concrete, reinforced with over half a million pounds of steel bars. The floors and supports for the 5-ft. pipe will require about 6,100 cu. yd. of plain concrete. The method of handling the forms and depositing the concrete in them is shown in the illustrations. The work is under the general direction of Mr. Ben. C. Adkins, Water Commissioner, and the immediate supervision of Mr. Edward E. Wall, Assistant Water Commissioner, who furnished the information for this article and the accompanying illustrations.

Chemical Gauging of Streams is proposed by Mr. C. E. Stromeyer, of the Manchester Steam Users' Association. About ten years ago he made some experiments in which the amount of feed water to marine boilers was measured by means of sea-water, and the circulating water was measured by means of caustic soda. Later, in engine tests, the condensing water and the heat rejected were measured by the injection of brine. More recently tests have been made on large streams in this way. In one case a three-day test of the delivery into a reservoir showed a flow of 0.6709 gal. a second by reservoir measurement and 0.6572 gal. by the chemical method. In another case, a small stream was estimated to flow 465 gal. by rod-floats and 473 gal. by chemical determinations. The weir measurement of the River Lea at Ware was 259 gal. per second, while the discharge measured chemically was 264 gal. Other cases of similar close agreement are mentioned in a paper Mr. Stromeyer recently presented to the Institution of Civil Engineers, in which the details of the chemical method of measurement are explained.

Some Unusual Accidents to Steam Engines.

The examinations of engine failures made by the engineers of the British Engine, Boiler & Electrical Insurance Co. often bring to light some unusual occurrences, which are described in the reports of Mr. Michael Longridge, the company's chief engineer. Among such unique cases investigated last year was one relating to a pair of horizontal tandem tri-compound engines, with cylinders 20 and 37-in. diameter on one piston rod and 32-in. and 37-diameter on the other. Stroke of piston, 5 ft., speed, 62 r.p.m.; boiler pressure, 160 lb. All the cylinders had Corliss valves for steam and exhaust. The high-pressure and intermediate cylinders were fitted with spring-loaded safety valves 1½-in. diameter, and the two low-pressure with similar valves 2-in. diameter.

The engine was started at 5:40 a. m. on the morning of the breakdown, and run slowly till 6 a. m. when the mill started, and it was put up to speed. Almost immediately the safety valves on the back end of the high-pressure cylinder began to blow violently. Thinking there was some water in the cylinder the attendant slowed down and sent word into the mill to throw off the load. Having run the engines slowly for a few minutes with the stop valve open only half a turn to clear the pipes and cylinder, as he thought, of water, he again opened the stop valve to run the engines up to speed. The safety valve at once began to blow, and almost at the same moment the back end cover of the high-pressure cylinder was blown off and fractured, one piece striking the gland on the front cover of the low-pressure cylinder just behind and breaking it. The high-pressure piston was forced so tightly on to the rod that it had to be split off.



Molds and Concrete Track for Building Walls.

The breakage was caused by excessive steam pressure. The key in the eye of the lever on the spindle of the exhaust valve at the back end of the high-pressure cylinder had come out, leaving the valve stationary and covering the exhaust port. Thus the compression curve, instead of starting at about nine-tenths of the stroke from the receiver pressure, started from the beginning of the backward stroke from the terminal pressure of the expansion curve, and except in so far as it was relieved by the 1½-in. safety valve by leakage past the steam valve and by cylinder condensation, followed that curve to the point of cut-off and then upwards till the steam admitted up to the point of cut-off was compressed into the clearance space.

The cut-off took place about half stroke at a pressure of 150 lb. per square inch, and the clearance was probably about 5 per cent. of the cylinder volume, so that the pressure at the end of the compression would have been $150 \times 0.55 \div 0.05 = 1{,}650$ lb. per square inch had there been no escape past the safety valve and past the steam valve. The safety valve was small and could lift but little owing to the closeness of the coils of the spring which loaded it, and the Corliss steam valve practically fitted the valve box. Anyhow, the relief they afforded was not sufficient to prevent the pressure blowing off the cylinder cover. The only extraordinary circumstance was that the cylinder end was not blown off with it. Fortunately, the cover studs failed first.

Another case was that of a high-speed inverted vertical engine of the "Universal" type, with cylinders 10 and 14½-in. diameter by 6-in. stroke, running at 450 r.p.m., supplied with steam from boilers working at 135 lb. per square inch, and discharging into an independent jet condenser cleared by horizontal double-acting air pump 12-in. diameter, direct-driven by a steam cylinder 6-in. diameter and 10-in. stroke. The surface of the water in the pond which supplied the condensing water was 12 ft. below the top of the condensing cylinder of the main engine. If, therefore, the air pump was standing and the injection cock were open, the water would rise into the cylinder under a vacuum of 5 lb. per square inch. To prevent this danger an atmospheric valve was provided, actuated by a float on the end of a lever fixed upon a spindle which passed through a gland in the side of the condenser. On the other end of the spindle outside the condenser was another lever and a connecting rod to lift the valve whenever the float was lifted by the water rising to too high a level in the condenser.

The arrangement of the engine is as follows: The high-pressure cylinder is placed on top of the low pressure. Between the two there are two Corliss valves. One of these admits steam from the boiler to the underside of the high-pressure piston, forcing it upwards. When it has almost completed its up-stroke it uncovers a number of holes bored circumferentially round the barrel near the top through which the steam which entered the cylinder at the beginning of the stroke escapes into the receiver. On the return stroke of the piston the holes are closed and the steam which was in the clearance at the beginning of the stroke is compressed by the descending piston. The steam discharged into the receiver passes at once through the second of the above-mentioned Corliss valves into the top end of the low-pressure cylinder, forcing the piston downwards. When near the bottom of its stroke this piston uncovers a ring of holes through which the steam escapes to the underside of the piston and to the condenser. Soon after the commencement of its return up-stroke the piston passes back over the holes and compresses the steam above it into the clearance space.

The breakdown occurred at 5:30 p. m., when the engine was being stopped for the day, and seems to have been caused first by the attendant shutting off steam at the junction valve on the boiler without closing the injection cock, and second by the failure of the atmosphere valve to act. By shutting off the steam at the junction valve he stopped the air pump instantaneously, for the pump had no flywheel to keep it going. The pump therefore failed to remove the water flowing into the condenser through the open injection cock. The engine, on the contrary, being provided with a heavy flywheel continued to be driven by the energy stored therein. The steam left in the cylinders when the junction valve was shut was at once condensed and a vacuum formed which allowed the atmospheric pressure acting on the surface of the pond to force water through the condenser up the exhaust pipe and into the cylinder till it filled the space below the piston. Then as the piston descended and uncovered the holes in the lower end of the barrel the water rushed through them into the empty space above the piston just as it rushes through the ports in the lower end of an Edwards' air pump into the empty space above the bucket. The upward return stroke of the piston carried the water imprisoned above it upwards till it met the cylinder cover, when there being no delivery valve as in the case of the Edwards' air pump, something had to give way. The cylinders were torn off the main casting which contained the air buffer and connecting rod.

The breakdown might have been prevented in several ways. First by shutting the injection cock before stopping the engine. Second, by shutting the engine stop valve and keeping the air pump going till the engine had come to a standstill. Third, by opening the atmospheric valve before stopping either pump or engine. Instead of adopting either of these methods, the attendant relied upon his automatic vacuum breaker and it failed him, as automatic contrivances sooner or later do unless constantly operated and proved by the man in charge of them.

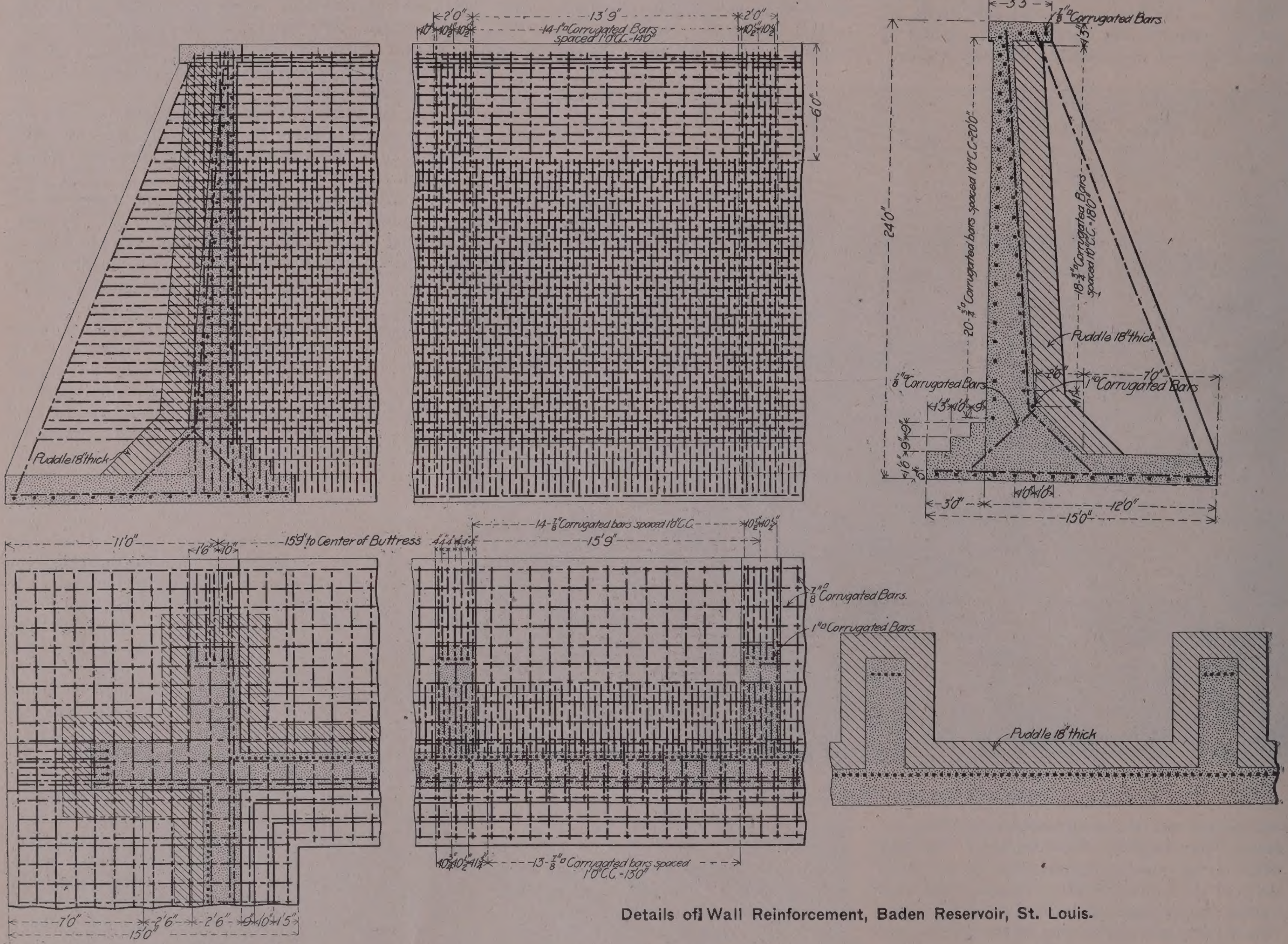
Another unusual accident happened to a pair of enclosed inverted vertical compound engines, supplied with steam from boilers working at 80 lb. per square inch, and discharging with an independent condensing plant. Cylinder diameters, 22 and 36-in.; stroke of pistons, 18 in.; speed, 250 r.p.m.

One morning the cover of the high-pressure cylinder cracked round the flange and the central part was blown off. The flange of the piston was broken off about half-way round, also the corresponding part of the piston cover and the packing rings were broken into small pieces. The engine was first set to work about the end of 1902, and with the exception of one or two breakages of piston rings seems to have run satisfactorily till the beginning of 1904, when the packing rings in the high-pressure piston began to break more frequently. In the first four months of the year four sets of rings were replaced, the last having been put in four days before the breakdown. When the piston was taken out a recess ¼-in. deep extending 5 in. circumferentially and from 2 in. to 2¾ in. vertically was found near the bottom of the cylinder just opposite to the steam port, and there is little doubt that the repeated breakages were due to the ends of the rings springing into this recess when the piston was near the bottom end of its stroke. The last set of rings being much heavier than the previous sets was strong enough to cause the breakage of the piston and its cover, and a piece of the latter thrown on to the top of the piston no doubt drove off the central part of the cylinder cover. The recess was probably a defect in the casting. The cylinder was delivered with the piston and piston rod in it, and as the crosshead was forged upon the lower end of the rod the piston could only be taken out of the cylinder by taking it off the rod, so that it was not taken out till after the breakdown, and consequently the existence of the defect in the cylinder was unknown.

Still another unusual accident happened to a horizontal compound tandem engine, with cylinders 15 and 30-in. diameter by 3 ft. 6 in. stroke, running at 72 r.p.m. The engine was originally fitted with a jet-condenser, but some time in 1903 was coupled up to an evaporative surface condenser standing in a tank above the engine room. The exhaust from the condensing cylinder was led into this condenser, and condensed by water running over the outsides of the pipes. Generally speaking, in such cases the condensed steam is taken from the hot well, and returned to the boiler through an oil separator, but in this a somewhat different arrangement was adopted for two reasons: (1) because there was no oil separator, and (2) because the quantity of feed required for the boilers was much greater than the discharge from the air pump, owing to steam being used for manufacturing purposes. Accordingly, a branch from the town main was led into the hot-well, and the hot-well connected to a double-acting jack pump 9½ in. diameter by 15½ in. stroke, which lifted the condensed steam from the engine and the supply from the town main together through a 3-in. pipe, into a trough placed 38 ft. above the pump, from which the water fell on to the pipes of the condenser and trickled down them into the tank in which they stood. From this tank the boilers were supplied.

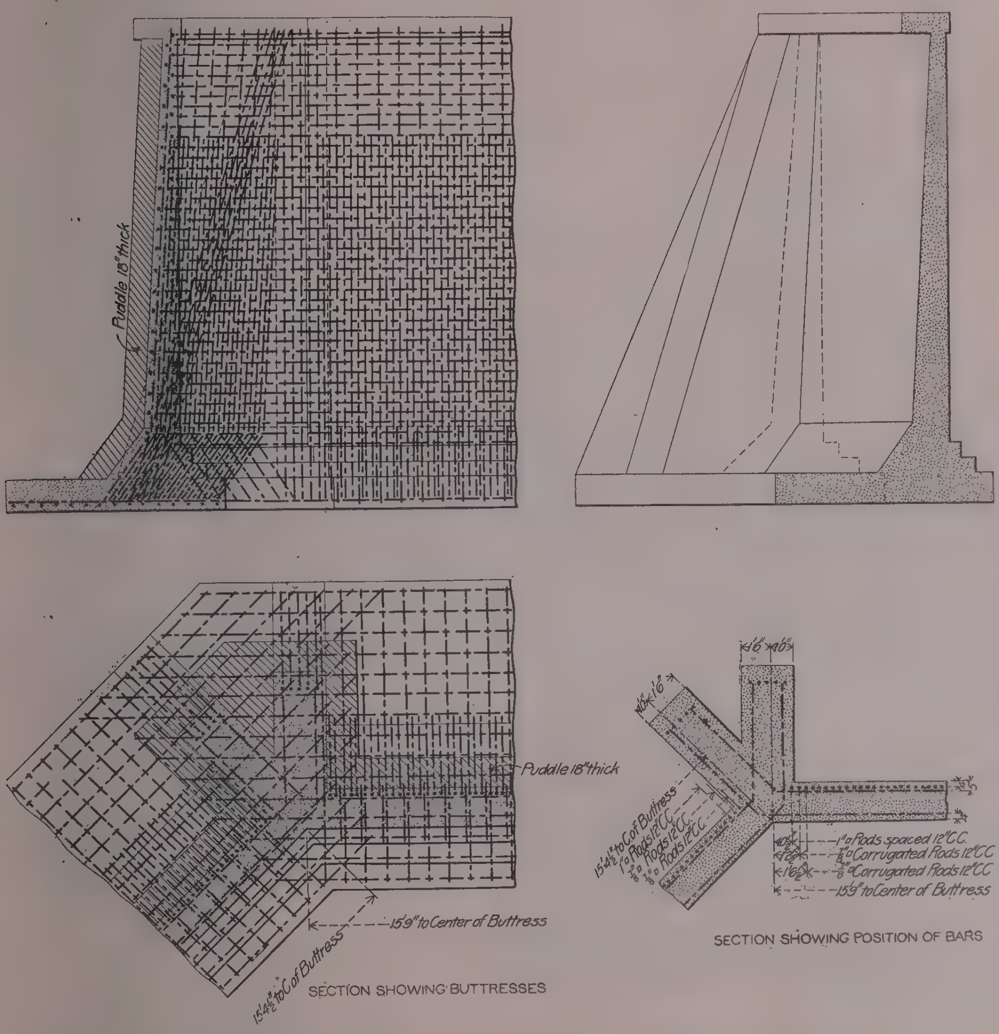
The valves of the jack pump were placed in a flat-sided box cast on to the pump, and one day this box was found to be seriously cracked and leaking on the delivery side. As the fracture was noticed when the engine was being started, it was suggested that the cock on the town main might have been left open or partly open, and the jack pump filled with water, and that the pressure due to the attempt to force the full displacement of the pump through the 3-in. discharge pipe was sufficient to rupture the discharge valve chamber. Seeing that the engine must have started slowly, this explanation is unsatisfactory. It seems more likely to Mr. Longridge that the valve chamber was weakened and gradually cracked by the force required to accelerate the motion of the column of water in the discharge pipe on the opening of the delivery valves, particularly if the discharge happened to be less than the capacity of the pump, causing intervals between consecutive discharges during which the water in the discharge pipe would lose its upward velocity, and if the intervals were long enough would come to rest.

Probably the greatest pressure in the valve chamber would occur if the pump were discharging half its capacity, for then the delivery valve would open when the piston was at half-stroke, i. e., when running at its highest speed, in this case 4.86 ft. per second. In the absence of an air vessel the equivalent velocity in the discharge pipe immediately after the opening of the discharge pipe would be 48.6 ft. per second, since the area of the pipe was one-tenth of the area of the piston. The velocity in the pipe just before the opening of the delivery valve is not known, but it must have been less than 10 times the mean velocity of the piston, i. e., less than 31 ft. per second. Therefore, at the moment of opening the delivery valve the velocity of the 116 lb. of water in the pipe had to be increased in a very short period of time at least from 31 to 48.6 ft. per second. The length of time available for effecting this increase of speed would depend on the leakage past the piston, and the elasticity of the water column depending on the quantity of air in it. If the time were 0.01 second the force required to change the velocity of 116 lb. of water from 31 to 48.6 ft. per second would be equal to a pressure of 925 lb. per square inch. It is not asserted that the pressure was 925 lb. per square inch. The figures are hypothetical, and are only given by way of illustration to show that rapid changes of the velocities of water flowing in pipes cannot be effected without very great pressures.


2'0"
13'9"
2'0"
10"
10½"
14-1" Corrugated Bars spaced 1'0" C.C.=14'0"
6'0"
Puddle 18" thick
11'0"
1'6"
10"
15'9" to Center of Buttress
14-⅞" Corrugated bars spaced 1'0" C.C.
15'9"
⅞" Corrugated Bars
1" Corrugated Bars
Puddle 18" thick
13-⅞" Corrugated bars spaced 1'0" C.C.=13'0"
7'0"
2'6"
2'6"
10"
1'5"
15'0"
3'3"
⅞" Corrugated Bars
24'0"
20-⅞" Corrugated bars spaced 1'0" C.C.=20'0"
18-⅞" Corrugated Bars spaced 1'0" C.C.=18'0"
Puddle 18" thick
⅞" Corrugated Bars
1" Corrugated Bars
7'0"
3'0"
12'0"
15'0"

Details of Wall Reinforcement, Baden Reservoir, St. Louis.

The magnitude of the forces required to put long columns of water into motion in short spaces of times are often much underestimated. This remark may be illustrated by a case which came under the notice of one of the company's inspectors. A steam pump, single-acting, with a plunger 1 9/16-in. diameter by 4¾-in. stroke, running about 62 r.p.m., received its supply from a tank through a 1in. lead pipe 3 ft. long, leading vertically downwards from the bottom of the tank, and coupled at the bottom by a union to a wrought-iron elbow carried vertically downwards for 12 in., and then horizontally for 2 ft. to the suction valves of the pump. The water level in the tank was 2 ft. 3 in. above the bottom, and therefore 5 ft. 3 in. above the union connecting the lead to the wrought-iron pipe. The pump had been running practically day and night for 14 years, during which time the lead pipe had gradually bulged out into a globular shape just above the union and finally it burst. The bulging was due to the pressure set up by the stoppage of the flow when the suction valve closed.



SECTION SHOWING BUTTRESSES

SECTION SHOWING POSITION OF BARS

Details of Reinforcement in Corner Buttresses, Baden Reservoir.

The Stoppage of Sewers by the roots of the Carolina poplar is causing so much trouble in Muncie that it is proposed to pass an ordinance forbidding the use of this species of tree along streets. Its roots seem to suck water with exceptional vigor, and the cement joints of vitrified pipe sewers do not resist them. It is stated that at one place where a bundle of roots 80 ft. long and 8 in. in diameter was taken out of a sewer early in the summer, it was necessary to go over the line again the following September for the same reason.

Steel Railroad Bridges.

The Committee on Steel Bridges of the Association of Railway Superintendents of Bridges and Buildings reported at the society's convention this week that it had sent out 150 circular letters of inquiry concerning certain features of such bridges of greater interest to the supervisor than the engineer, and had prepared the following summary of the replies:

Erecting Bridges.—For handling material derrick cars are very generally preferred, being used in some cases with extension booms to erect the top chords of the highest trusses. Wrecking cranes are mentioned by several, but these can be used only for setting girders; while properly equipped derrick cars are applicable to a variety of structures.

Travelers are used for erecting truss spans by some, but derrick cars are replacing travelers wherever available; one writer claiming that trusses are erected as cheaply as girders where the use of travelers can be avoided.

A majority erect girder bridges and sometimes truss spans at one side and slide them into place between trains. Generally trusses and sometimes girders are erected in place and the floor shifted in between trains. The method adopted depends very largely on traffic conditions. One member builds a temporary track around the site where traffic is very heavy. Gallows frames are mentioned for handling very heavy girders, but not to the extent that they deserve; and for deck-plate girders of moderate spans, riveted up complete, a pile driver is suggested as a convenient tool for handling one end.

The cost is given by only a few correspondents, $4 to $20 per ton being the range; girders are quoted at $4 to $10, and truss work $10 to $20. Transportation of material, tools and men is not included in these prices.

Riveting.—There is practical unanimity in recommending pneumatic riveters where the work is of sufficient magnitude to warrant it. Only one reply expressed a preference for hand-driven rivets. Small jobs and sometimes large ones, due to lack of a sufficient number of air plants, are driven by hand, so that work ought to be designed in all cases on the basis of hand driving for field work.

Cleaning and Protecting Steel.—Nearly all the replies report hand cleaning. Four or five have used the sand blast with good results, but it is quite expensive. One has used a strong solution of lye with marked success for cleaning steel for painting. Several parties not using the sand blast express a favorable opinion of it. Those having considerable experience with it, think it practically indispensable where the steel is badly scaled and pitted. When this condition obtains it is not possible to clean iron by hand so but what a coat of paint will be quickly thrown off.

Where ordinary weather rust occurs it can be kept under control by ordinary cleaning and painting, if in about a year after the work is done, it is gone over and the spots which show rust a second time are touched up. Certain exposed parts of a structure become rusted before others, of course; and if these parts were repainted two or three times to the other parts once, economy would result. Painters, however, dislike to paint by patchwork, and the result is that the exposed parts are allowed to get beyond control before it is decided to paint the structure as a whole.

As to kinds of paint used, no two replies agree. Several are experimenting with hopes of learning something valuable. It is pretty well ascertained that no one kind of paint is the best for all conditions. Asphaltum paints are much better in sheltered places than in the sun. Linseed oil paints are much better in the sun than in dampness. Inert pigments in gum vehicles are better where exposed to engine gases than metallic pigments. An absorbent of moisture is a desideratum for a priming coat. It will be admitted that it is asking much of a film of paint only one one-hundredth of an inch thick, to protect a material so readily oxidizable as our open-hearth oxygen-filled steel, from the corrosive action of engine gases, brine and the weather for a term of years.

It is manifest that the final word has not been written yet on the paint question. The American Society for Testing Materials is doing valuable work investigating the matter. For train-shed roofs the P. R. R. at Jersey City has found it advisable to cover each member of iron work with a thin parafine paper smoothed on to a coat of undried paint, and then to paint two coats over that. It seems to protect the iron perfectly.

Corrosion of Floors by Brine.—Over half the replies report no trouble, or but very little on this score, on account of absence of refrigerator cars from their traffic. Several report a good deal of trouble but use no remedy except frequent cleaning and painting. Mr. Loweth, of the Chicago, Milwaukee & St. Paul, writes: "I have lately been covering the tops of stringers and beams with a cotton ducking saturated in a preparation of linoxyn and a resinous flux. This prepared canvas is ironed hot on to the steel surface and adheres more or less perfectly, and I hope to get good results from it; but have not had it in service long enough to say positively. This preparation is called "iron bark," and is manufactured by the Edward Smith Co., New York." Mr. Cartlidge, C., B. & Q. R. R., writes "We find that a concrete deck with ballast is an absolute preventative of trouble, and are employing that wherever possible. On bridges where a concrete deck cannot be used, we are having good success with felt roofing; cutting it into strips slightly wider than the flanges of the stringers and placing it there and underneath the ties, first painting the iron with the compound used with the roofing."

Erection by Railroad Forces.—A majority of the replies favor erection by railroad forces. Those representing the larger systems generally erect all bridges with their own men. Very few prefer contractors for all bridges. About one-half of the replies favor contractors for large jobs and road forces for girders and small structures.

If a railroad system is large enough to keep a force of men and equipment constantly employed the work can certainly be done more economically by them than by contractors, but if idle times occur, the case will be reversed. Railroads of moderate size must maintain repair gangs for making running repairs on iron bridges and these men, supplemented with carpenter crews, can put in small structures. The independent firms who make a specialty of erecting bridges furnish a means for those roads to contract the erection of large bridges independently of the builders, when the latter wish to eliminate erection from their contracts.

Concrete Pedestals for Five-Foot Pipe, Baden Reservoir.

View of Back of Reinforced Wall, Baden Reservoir.

There is no difficulty, as some maintain, in having outside parties erect bridges and care for falsework under traffic. The question then resolves itself into one of economy; and it is evident that where such work can be made continuous, railroad men can do it cheapest, but when but little is done the larger jobs should be contracted.

Spacing of Stringers.—The replies to this inquiry vary from 5 to 8 ft., several stating the practice on their road and giving a preference for a narrower spacing. No one desires a wider spacing than their standard. One, whose stringers are spaced 7 ft., 6 in. to 8 ft. 6 in., prefers 7 ft. Another, with 5 ft. to 7 ft. spacing, prefers 5 ft. Those using four stringers per rail say nothing against the practice; while several using single stringers per rail, object to the possible unequal distribution of the load where more stringers are used.

Where more than two stringers per track are used, the practice varies; one using four stringers spaced 2 ft. 6 in. on centres, all through, making 7 ft. 6 in. centres of outer lines; another has the inner ones 2 ft. 10 in., and the outer 6 ft. 10 in. on centres; and another, the inner ones 5 ft. and the outer 10 ft. In the latter case the inner stringers are designed for the full load and the outer ones on a lower assumed basis for safety in case of derailment. The former two cases have stringers of equal section on the assumption that the load is equally distributed between them.

This subject should evidently be studied further by the committee. The practice is so divergent that some one must certainly be wrong. The length of standard tie is one element of the problem. The amount that we feel justfied in depending on the wooden tie to act as a beam to help out the iron floor beam is another element; and the amount of overhang outside the stringer, that we can admit is a third.

Mr. Carpenter, Southern Railway, says: "Our steel viaducts are . . . spaced 7 ft. and 10 ft., and in one case as much as 11 ft. centres. I think 10 ft. and 11 ft. centres too much, as we do not get the life of the timber in the cross-ties that we do at 7 ft. centres."

Finishing Ends of Stringers.—The replies are unanimous in favor of squaring the ends of stringers. This is remarkable, as it is certain that many roads do not follow this excellent practice. It is pertinent for the committee to extend this inquiry to deck-plate girders, which can be squared as readily as stringers, although it is frequently not done.

Breaking of Bridge Seat Stone.—Six of the replies report no trouble. The rest report some trouble from breakage of limestone under bearings, especially when they were imperfectly embedded when they were set. Sandstone, granite and concrete give no trouble. One member complains of breakage of stone under stringers, due to the tearing out of anchor bolts by the movement of the bridge from temperature changes. The design must be defective in such cases, for the stringers should be free to move on wall plates.

Pin and Riveted Trusses.—Of thirteen replies to this inquiry four prefer riveted trusses to pin; three prefer pin to riveted; and four prefer riveted to pin up to certain limiting spans, running from 130 to 160 ft. Two express no preference, but state that a few riveted trusses have recently been put in on their lines and are giving good satisfaction. Some trouble from the wearing of eyebars on pins is reported, and one advocate of pin connections would make the threaded portion of the pins long enough so that a hole for a cotter pin can be bored outside the nuts. One member on a large and up-to-date road states that his practice is growing towards the larger use of riveted connected trusses, and the observations of your committee accord with this view.

This question, outside of the maintenance features of the two types of trusses, is hardly within the purview of this Association. It was threshed over pretty thoroughly by engineers thirty years ago; with the result of concluding that either type, within proper limits of span, was all right if properly designed and built. Pin trusses are cheaply and quickly erected; this consideration led to their almost exclusive adoption in some sections of this country; and, without question, they have been built in the past for spans where riveted work would have been much the best. The tendency, noted above, to build riveted trusses for longer and longer spans shows the recovery from the pin-truss fad.

Super-elevation on Curves.—The replies to this question vary widely. Of fifteen replies five are in favor of putting the elevation in the ties, eight prefer putting it in the stringers, and two use raising strips on the stringer or girder under the ties. One tilts spans under 50 ft., and the method of working the elevation into the ties varies. The point is made that tapered ties are not of equal strength throughout. This argument loses its force if the main stringers are five ft. on centres. The arrangement of the iron floor affects this question, and it will be well to study both questions as a unit.

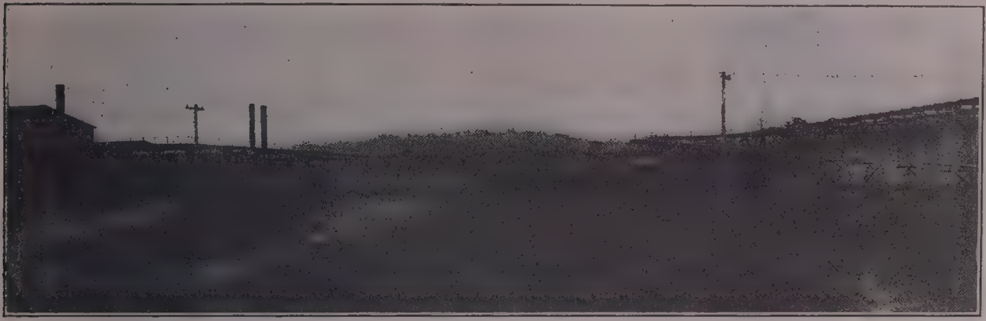
The report is signed by H. H. Egglestone, Chicago & Alton Ry.; J. R. Snow, Boston & Maine R. R.; C. H. Cartlidge, Chicago, Burlington & Quincy Ry.; H. M. Trippe, and J. W. Lantry, New York Central Lines.

Traction Experiments with ordinary farm wagons have been made for the past three years by the Civil Engineering Department of the Iowa State College, and very valuable data have been obtained. The average pull in pounds per ton on an old and very dirty gravel road in the worst spring condition is about 190 to 200 lb., and on a better gravel road in the same condition about 135 to 150 lb. The traction on these roads in ordinary dry condition is between one-third and one-half the amounts mentioned. On earth roads in the worst spring condition the pull per ton ranges from 234 to 531 lb., averaging about 330 lb. In dry weather the pull on these roads is from 83 to 215 lb., averaging about 125 lb. These tests were made with farm wagons having 42 and 52-in. wheels and 1¾-in. tires, and show clearly the effect of bad roads on traction.

The Works of the Kosmos Portland Cement Co.

The Kosmos Portland cement plant at Kosmosdale is the first Portland cement works in the State of Kentucky. The ground was broken on June 3, 1904, for a 1,000-barrel plant, but the plans were prepared for an extension to 3,000 barrels without interrupting the manufacture of of cement and with a comparatively small additional outlay of capital.

Limestone and clay are the raw materials used. The clay land surrounds the site on which the plant is built (800 acres), and varies in depth from 5 to 15 ft. As there is very little stripping to be done, it is only necessary to plow and harrow the clay and draw it by drag scrapers to a 120 x 125-ft. storage shed. From this shed the material is taken directly to the dryer building, where it first enters the plant. The composition of the clay is very uniform and the average of the number of analyses is as follows: SiO_2, 64.86; Al_2O_3, 19.66; Fe_2O_3, 6.27; CaO none; MgO, 1.23; SO_3, none; loss on ignition, 6.12.



Cable-road Trestle, with Outside Storage of Coal and Stone at Right.

The limestone is of oolitic formation and is brought from the company's quarry, about 28 miles below the site of the plant, on the Ohio River. It averages over 98 per cent. chemically pure carbonate of lime, and is almost totally free of magnesia. The average analyses is: SiO_2, 0.61; Al_2O_3, 0.36; $CaCO_3$, 98.56; MgO, 0.31.

Quarry.—The quarry, which, as stated before, is located about 28 miles below the site of the plant, rises precipitately from the edge of the river to a height of 200 ft. It is open-faced and the floor is some 125 ft. above the river. Cars running on portable track discharge into a large chute holding 200 cu. yd. of stone, whence the rock is discharged into two No. 5 Gates crushers, built by Allis-Chalmers Co. The crushers discharge on to a 24-in. belt conveyor 250 ft. long, made by the Link-Belt Machinery Co. This conveyer empties into a steel chute, which in turn discharges into barges some 60 ft. below. The portable track and steel dump cars were supplied by Arthur Koppel Co.

The power equipment consists of a 150-h.-p. tandem compound engine and two 100-h.-p. return tubular boilers, all made by Atlas Machine Works, of Indianapolis, Ind. Rand steam drills are used. The barges owned by the company are built of oak and are 130 x 30 x 3 ft., and hold about 500 tons of crushed stone.

Plant.—At the plant the stone is unloaded from the barges by means of a Hayward bucket, operated by a 5-ton derrick, which is 92 ft. in height and swings a boom 75 ft. long. The derrick was erected by the American Hoist & Derrick Co., and is operated by electricity, Westinghouse motors being used.

The stone is dropped into pockets holding about 250 tons, which in turn discharge, under control of an operator, into small cars, running on a narrow-gauge cable road to the plant some 1,800 ft. away. The cable road and equipment were supplied by the Mead-Morrison Manufacturing Co. The cable road, altogether, comprises about 5,000 ft. of trackage, part of which is the main line to the plant and part is used for conveying the stone to the large storage buildings. Coal for the plant is brought from Pittsburg in barges and is handled in the same manner as the stone.

In addition to the large storage buildings for stone, which will be used only in case of emergency, such as freezing of the river or a long, dry season when the river will be too low for navigation, there is a small storage building immediately adjacent to the dryer building, which contains about ten days' supply. A tunnel runs through the center of this building and through the tunnel there is a 24-in. flat conveyer. From any point in this stone storage building rock can be discharged into this conveyer and carried automatically to the driers.

Concrete Laboratory Building at Kosmosdale.

The drier building contains three 60 x 6 ft. rotary driers, equipped with Z-shaped shelves. Two of these are for stone and the third for clay. The building is 52 x 120 ft., and it contains in addition to the ordinary method of sending heat through the driers an equipment for additional external heating.

The driers were manufactured by the Vulcan Iron Co. From this building the clay passes directly into the mixer building, which is 45 x 52 ft. From the driers the stone is conveyed on a 24-in. conveyer at an angle of 21 deg. to bins in the raw material building. These bins feed into three Allis-Chalmers ball mills. From the ball mills the crushed stone is taken to the mixer building. In this building the materials are mixed in the proper proportions for the making of cement, as determined by chemical analysis. An automatic weighing machine, manufactured by the Automatic Weighing Machine Co., of Jersey City, has been installed for this purpose. This machine can be regulated according to the variation in the composition of the materials, and this is done daily, or oftener as necessity requires by the chemist.

The mixed material is conveyed from the mixer building by a cut-flight screw conveyer, which further mixes the clay and limestone, to the raw grinding building and into bins placed over three Allis-Chalmers tube mills. The raw material building is 60 x 74 ft. From the tube mills the finely pulverized and thoroughly mixed material is taken by a conveyer and elevator to the stock bins above the kilns in the kiln building, which is 125 x 126 ft.

The kilns in the plant, as it is at present, are four in number and are 80 ft. long and taper from 7 to 6 ft. in diameter. The kiln building is the characteristic feature of this plant, as the kilns and boilers occupy the same room. This is due to the fact that the waste gases from the kilns are utilized for steam purposes, the gases from each kiln entering a Wickes vertical tubular boiler, and after passing through it, are drawn through a Green economizer and thence up the stack. An induction draft fan is placed in the base of the stack in order to insure proper draft. If any additional coal is necessary for making steam, it is fed by hand, as in any other boiler.

From the kilns the clinker is conveyed by a Link-Belt Machinery Co.'s overlapping steel bucket conveyer to a weighing machine, which automatically measures the amount of clinker. This is then discharged into a Sturtevant mill, which discharges its product into an elevator and the elevator into a conveyer, which carries the clinker to the 52 x 120-ft. clinker storage building. This building is specially arranged for storing clinker for a period of from four to five weeks, and is equipped with screw conveyers running in concrete trenches across the floor of the building, which discharge into one large conveyer running at right angles. This takes it into another weighing machine, which automatically weighs the clinker and adds the necessary amount of gypsum. From here another screw conveyer carries the material to the ten Griffin mills in a 68 x 60-ft. building. From here the material is taken to the stock house, which is 74 x 135 ft. and is divided into three tiers, the foundations of which are 15 ft. high and made of reinforced concrete. The walls are made of cement plaster and expanded metal. The packing house adjoins the stock house and runs the entire length of it, and is 26 ft. in width. It is equipped with up-to-date facilities for packing and shipping.

Fuel and Power.—Coal is taken from storage by means of a flat conveyer inside a tunnel similar to that described for the stone, and is passed through a Sturtevant mill before entering the coal drier, which is 50 x 5 ft. After passing through the coal drier, which is equipped for internal and external heating, the coal is passed through Allis-Chalmers' tube mills, which are controlled by separate motors. From the tube mills the coal is directly conveyed to the kiln building and discharged into bins back of the kilns. The coal building is 136 x 40 ft. and has been designed with special attention to rendering it fire and explosion proof. It is divided into three compartments, which are separated by solid masonry walls. One department contains the drier, the second the tube mills and the third the motors and driving gear. This building is placed a safe distance from the rest of the plant.

The power house is 52 x 120 ft. The equipment consists of a 550-h.-p. tandem compound engine and a 440-h.-p. tandem compound engine manufactured by the C. & G. Copper Co., of Mt. Vernon, and two 300-h.-p. De Laval steam turbines. The power for the whole plant is divided into two parts. The two Corliss engines take care of the entire grinding and the power house is, for this reason, placed directly between the raw grinding building and the cement mill building. The two Corliss engines are each direct-connected with a shaft, which runs in the case of one engine through the raw grinding room, and in the case of the other through the cement room. This avoids any loss in transmission of power, as the mills are operated by means of friction clutches on this main shaft. The rest of the power used about the plant is electric and is used for the operation of the derrick and cableway, the machinery in the coal building, the kilns, blowers, driers and pumps. Superheated steam is used in connection with the engines and turbines.

The boilers, four in number, each of 250-b.h.p. capacity, as was said before, are placed in the kiln building. These boilers are of the vertical type, manufactured by Wickes Bros., and are equipped with Shelby tubes.

Westinghouse motors are used throughout the plant where electric power is used. In the basement of the power house are the Worthington boiler feed and fire pumps. The system of condensers was made by H. W. Bulkley & Co., and the pumps for it were furnished by the P. H. & F. M. Roots Co. The screw conveyers throughout the plant were made by the H. W. Caldwell & Sons Co., and the elevator and flat conveyers by the Link-Belt Machinery Co. The kilns and driers were furnished by the Vulcan Iron Works. All steel work in the bins, bridges and buildings was supplied by the Russell Wheel & Foundry Co. The buildings of the plant are steel frame work covered with expanded metal and walled with cement plaster. A complete fire system has been installed.

In addition to the buildings already mentioned, there are a completely equipped machine shop, carpenter shop, a store house, oil house, laboratory and office building. A number of houses have also been erected for the employees. These were built out of concrete and have shingle roofs.

The water used for condensing purposes as well as for use in the boilers is pumped from a large pond, located within a few hundred feet of the plant. When necessary, water is pumped in this pond from the Ohio River.

Shipments of cement can be made to points along the river by river transportation as well as by rail.

Mr. Samuel Horner, Jr., is president of the company, Mr. Robert Horner vice-president and treasurer, Mr. W. H. Baker superintendent, and Mr. C. M. Dugan, Jr., chemist.

Economizers and Vertical Boilers Utilizing Kiln Gases, Kosmos Works.

Notes on Power Station Design.

Extracts from a paper read before the American Street Railway Association by Mr. Fred N. Bushnell, chief engineer of The Rhode Island Co., Providence.

The practice of different engineers has gradually worked toward a type of station which is now so generally adopted for street railway work where limitations are not placed upon the design by the size or shape of the available site, that it can fairly be said to represent standard practice in modern power station engineering. In stations of very large size the boilers are frequently arranged in two tiers, or in groups, each group having its own chimney and flues and independent systems of feed and steam piping. This arrangement is now generally referred to as the unit system, the distinguishing feature of which is that the boilers, engines and generating apparatus are arranged in separate units or groups, each of which embodies all of the essential features of a complete generating plant, and the great advantage of which lies in the fact that trouble with any single piece of apparatus is localized, so that its effect is felt only in that unit of which it forms a part. Provision for carrying the load in the event of a breakdown of any important part of the apparatus is made by installing an additional or spare unit.

While the unit system is now almost universally employed in the larger power stations, it is usually somewhat modified for smaller plants where the liability to interruption of the service is not so great or the results so disastrous, the chief difference being in the arrangement of the steam and feed piping. The steam piping from the boilers is run to a longitudinal header, from which the connections to the engines are taken off at convenient points. This steam header is divided into sections by means of gate valves, which permit of any section being cut out at the convenience of the operator for the purpose of making repairs. Usually two systems of feed piping are provided, one of which supplies hot water to the boilers through the heaters and economizers, while the second, or auxiliary system, supplies cold water, or water direct from the heaters, in case of trouble with the main system. This arrangement of piping provides sufficiently against interruption in small and medium-sized plants, and in a system carefully laid out with due consideration for the troubles which are likely to arise, it is hardly probable that the disarrangement of any one part will cause serious interruption of the service.

If possible the station should be located near an ample supply of water for condensing purposes, in order to secure the advantages from the use of the most efficient types of steam apparatus, and if possible, convenient also to a steam railroad or tide water, where the coal can be received and handled for the least expenditure of labor. Its location in reference to the distributing system will depend upon the extent and type of the system employed. If the direct-current system is used, it will be desirable to select a location as near as possible to its center of gravity in order to reduce the investment in copper, but in the case of an alternating-current distributing system, this is of less importance, and greater consideration will be given to the cost of the available site, the nature of the soil, cost of foundations, etc.

In determining upon the dimensions of the building, it is important that ample room be provided for all of the apparatus to be installed, so as to avoid unnecessary crowding. Passageways should be provided between each battery of boilers, and at the rear for the convenience of attendants in cleaning the tubes and connections and for making necessary repairs. Sufficient room should also be provided around each piece of apparatus in the engine room, so as to enable the attendants to inspect it regularly and keep it thoroughly clean, and to provide for the removal of any part in case of repairs.

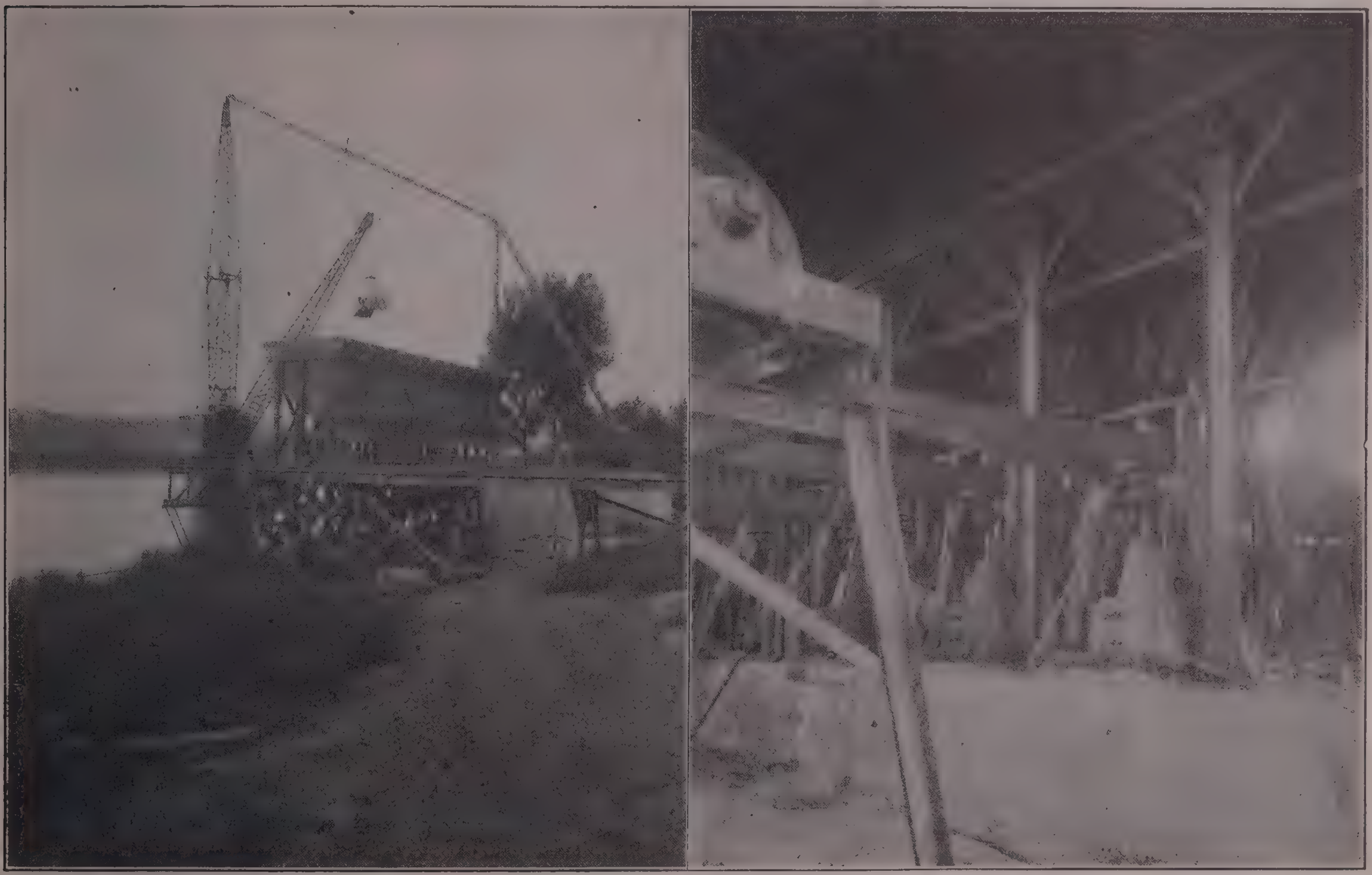
Cleanliness is absolutely essential to the successful operation of an electric railway power station. It is necessary that the building itself be kept free from oil and dirt, and each piece of apparatus thoroughly clean at all times, in order to maintain it in its highest state of efficiency. The designing engineer should contribute his share towards this result by providing ample light throughout the building—boiler room as well as engine or generator room. All the walls of the building should be painted in some light shade, preferably with some kind of enamel paint which can easily be washed down and kept clean. This will be found to reflect the light into dark corners of the building or spaces around the machinery, which might otherwise form receptacles for dirt and rubbish. It will add very much to the cleanliness and general appearance of the plant, and will contribute toward its successful running.

In designing a power station, the primary object in view is to deliver power at the bus-bars for the least expenditure of money, due importance, of course, being given to reliability of operation, which is the controlling principle in power station work. The fixed charges—interest, depreciation, insurance and taxes, should be as carefully considered as the cost of fuel, labor, supplies, repairs and other items which make up the operating expenses. Consideration should be given to each of these elements in proportion to its importance as a factor in the cost of power. In the great majority of cases fuel is the most important item of expense, frequently amounting to more than all other operating costs combined, and the perfection of these details of design and management which will effect the greatest economy in its use will usually make the best return tor the time and labor expended.

Electrical apparatus has now been developed to such a state of perfection that in a well-designed and carefully managed power station over 90 per cent. of the power of the engines is converted into electrical energy and delivered to the transmission system for the operation of cars. It appears, therefore, that no very great gain in coal economy is to be expected from the further improvement of electric generators or switching apparatus, and engineers are directing their efforts more than ever before to the steam portion of the power station, which offers a more promising field for a reduction in the cost of power.

The number and size of units to be installed is one of the most important problems bearing upon fuel economy which the engineer is called upon to solve. In order to obtain the maximum efficiency from the prime movers and their auxiliaries, it is necessary that they should be proportioned to the load they are intended to drive, so that if possible they may be operated at all times at or near their rated capacity.

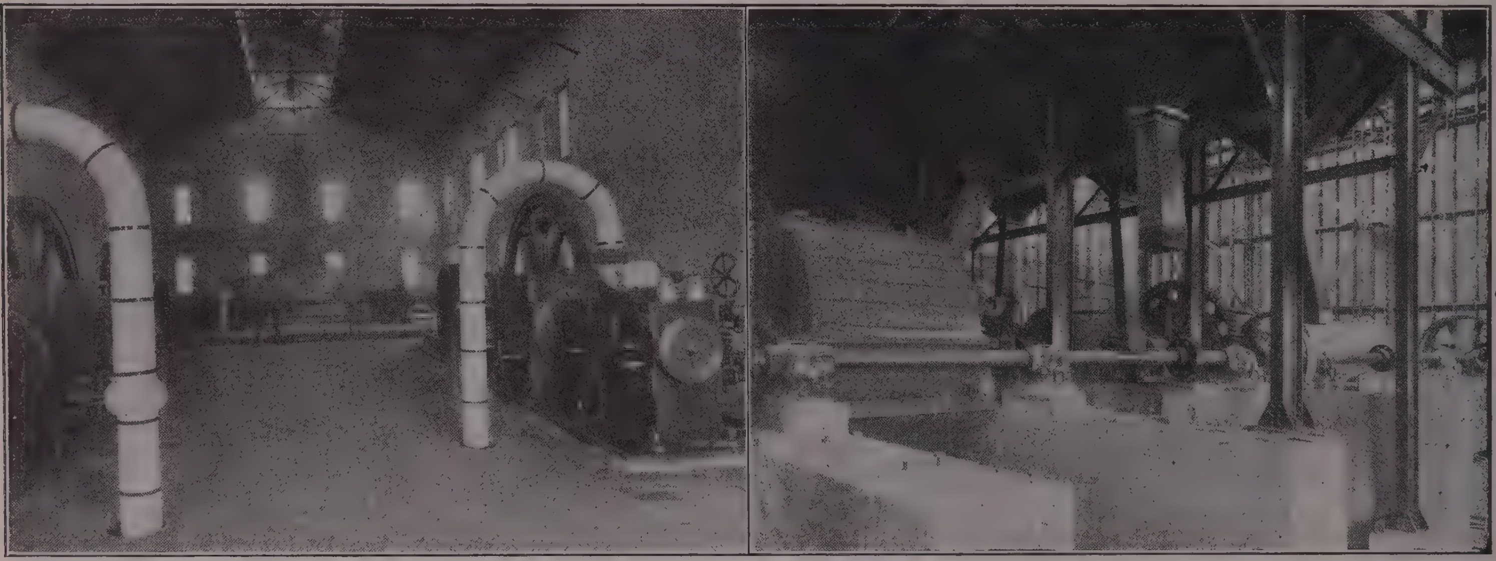
In electric railway power stations it is not regarded as practicable to change the speed of the air or circulating pumps, or to alter the quantity of cooling water, to suit the varying loads upon the station, and these auxiliaries are usually operated at a point sufficient to take care of the maximum load. The power required to drive them is therefore practically constant, and their steam consumption per unit of output will vary indirectly as the load on the main engines. Under ordinary operating conditions, where the exhaust steam is used for heating the feed water, only about 12 per cent. of the heat in the total steam generated can be used for this purpose, and all steam used by the auxiliaries in excess of this must go to waste; and it follows that in addition to the losses due to the reduced efficiency of the prime movers at light loads, the percentage of loss in the auxiliaries will increase very rapidly as the load upon the main engine decreases, and the best economy of the entire plant will be obtained only when the engines are operated at or slightly above their rated capacity.



Wharf for Stone and Coal, and Cement Grinding Room, Kosmos Portland Cement Works.

A comparison of the operating statistics of two railway power stations illustrates the importance of proper attention to this subject. For convenience they will be referred to as Station A and Station B. Both stations furnish power for suburban railways upon which sufficient cars are run to provide a fairly uniform load during the greater part of the day, although subject to more or less violent temporary fluctuations. The general designs of these stations and their equipments are such that the fuel used per kilowatt-hour should be practically the same, provided the engines could be kept well loaded in both cases. In Station A there are three units, and the load conditions are such that one unit is operated during the night and early morning, when the travel is light; two are operated during the greater part of the day, and three at the peak of the load, which occurs shortly after 6 o'clock in the evening. By careful attention to the changes in the load, it is always possible to keep the running engines fairly well loaded.

In the case of Station B there are two units. The load at night and early morning is very light, so that the engine used is only about half loaded for this period, whereas for the greater part of the day the load is a little more than one engine should be required to carry, and it is therefore necessary to run both engines. The result, of course, is that the average load on the station is only a little more than 50 per cent. of the rated capacity of the running engines, and they are, consequently, extremely wasteful of steam; and, too, the exhaust from the auxiliaries is probably quite a little in excess of that required to heat the feed water, which will also account, in a measure, for the low efficiency of the plant. Five pounds of coal per kilowatt-hour is the record of this plant, as compared with 3.8 lbs. for Station A. The greater part of this discrepancy is undoubtedly due to the more efficient load conditions in the latter station. It is probable that had a storage battery been added to the equipment of Station B, the load on the engines could have been regulated so as to have made a much better showing in coal consumption, but it is still problematical if there is any net gain from the use of storage batteries in railway work, and Mr. Bushnell is disposed to think that the use of three smaller engines in place of two large ones would have been the proper solution of the question. Undoubtedly a saving in coal of from 15 per cent. to 20 per cent. would have resulted from the use of engines better proportioned to the load.



Engine Room with Turbine Platform at Rear, and Raw Grinding Room, Kosmos Portland Cement Works.

Having ascertained the power required during the different hours of the day, the plant should be divided into as few units as will enable the engines and generators to be operated at or near their rated capacity, while at the same time a sufficient number should be installed so that in the event of trouble one can be shut down without causing interruption of service. A three-unit station will permit of a fairly uniform distribution of the load in small street railway plants, and in case of accident to one unit, the other two should be able by overloading, to supply sufficient power until repairs are completed. This number of units is therefore regarded as the minimum which should be installed in any power station.

The type of apparatus to be used, whether alternating or direct-current, will not materially affect the design of the station except in so far as the question of the use of reciprocating engines or steam turbines is involved. Up to this time the steam turbine, which is rapidly growing in favor for electric railway work, has been designed almost exclusively for use in connection with alternating-current generators. It is probable that this will be the case for some time to come, but it is interesting to note that considerable progress is being made in the development of direct-current turbo-generators. A number of machines of this type as large as 500-kw. capacity are in operation, and work is well advanced upon units as large as 2,000 kw.

Engineers have been prepared to welcome any form of prime mover which could be shown to possess any considerable advantage over the reciprocating engine, as the latter had come to be regarded as having largely fulfilled its possibilities, and no very great improvement in economy was to be looked for. The remarkable progress made in the manufacture of these machines, and their general adoption by many of the most progressive railways in the country, proves them to be a most formidable competitor of the reciprocating engine. It is to be regretted that most of the data upon the efficiency of steam turbines have been derived from tests covering very short periods of time, ussually only a few hours, and that so few data are available of their performance under actual service conditions. To the street railway manager or engineer, power station records for long periods, showing the coal consumed per kilowatt-hour, or, better still, the efficiency of the plant expressed in percentage of heat energy in the coal converted into electrical energy at the switchboard, are of much greater interest and value than the record of any number of short-time tests for steam consumption only, as it provides him with a much more practical means of making comparisons with the performance of other stations with which he is familiar.

One of the plants where turbines are exclusively used is the Quincy power station of the Old Colony Street Railway Co., and through the courtesy of P. F. Sullivan, president of this company, Mr. Bushnell was able to give some information regarding the performance of this station. This information was kindly furnished by C. F. Bancroft, superintendent of motive power and machinery.

The station was described in this journal on June 10. Only two of the five turbines in the station are required for the present work. One of these machines is run for 17 hours, and one for 24 hours per day. When the station is in full operation there should be a more uniform load, and it is expected that the station efficiency will be considerably increased. At present, while only two units are in operation, the feed water is heated to 200° F. by the exhaust from the steam auxiliaries. The average daily output is 52,500 kw-hours, giving a load factor of 54.7 per cent. for the two machines. Georges Creek Cumberland coal is used, having an average calorific value of 14,000 B. t. u. per pound. The average coal consumption for this station, operating under the conditions outlined above, is 2.94 lb. per kilowatt-hour, showing an efficiency of 8.36 per cent. This record covers a period of six months, ending June 30, 1905.

While this performance does not furnish conclusive evidence of the superiority of the turbine over reciprocating engines in electric railway work, it compares favorably with the results obtained in a large number of the better class of stations using the latter type of prime movers, and gives some force to the opinion that in actual practice there will be found to be very little difference in the coal consumption of steam turbine and reciprocating engine plants operating under similar conditions.

In order to develop the highest efficiency of the steam turbine, it is necessary to operate with a very high vacuum. It is claimed that each inch of vacuum above 26 in. will increase the economy from 3 to 4 per cent., and condensing apparatus is usually recommended which will produce a vacuum of about 28 in. of mercury, or 2 to 2½ in. higher than that regarded as the most efficient for reciprocating engines. The type of apparatus generally installed consists of a surface condenser with a centrifugal circulating pump, dry vacuum pump and hot-well pump. In practice no trouble has been experienced in obtaining the high vacuum desired with this type of apparatus, but whether the gain of 3 per cent. or 4 per cent. in coal is sufficient to warrant the additional first cost and cost of operating this rather complicated system, is a question which would seem to be open to discussion. In cases where the cost of feed water is a material factor in the cost of power, or where it contains a large percentage of calcium or magnesium carbonate, or other scale-forming materials, there will be great advantage in using a surface condenser on account of the pure distilled water returned to the boilers, but where these conditions do not exist, it will frequently be found to be practicable to use some simpler form of condensing apparatus, such for example as the injector or barometric type of jet condensers. These types of condensers offer very great advantages over the surface condenser in the matter of lower first cost, space occupied, greater simplicity and less cost of maintenance. Up to this time they have not been very generally used, but there seems to be no good reason why they should not work as satisfactorily in connection with steam turbines as with reciprocating engines, and when properly proportioned to the work and installed with tight piping throughout, it is believed that in many cases they will prove to be as satisfactory as the more complicated types.

A considerable economy in the steam consumption of both reciprocating engines and steam turbines has been shown to result from the use of superheated steam. In plants equipped with either of these types of prime movers using dry saturated steam, the introduction of superheated steam can generally be depended upon to effect a saving in steam of about 1 per cent. for every 8° or 10° of superheat. Where the quality of the steam is not so good, and the conditions are such that the condensation in the pipes or cylinders of the engines is excessive, the saving may be much greater than this, sometimes amounting to 1 per cent for every 4° or 5° of superheat. Unfortunately, superheated steam is now known to be rather expensive to produce, particularly at the higher temperatures, and consequently economy in steam consumption does not necessarily mean economy in the consumption of coal. The chief advantage in its use is obviously in the saving which can be made at the coal pile, and unless this saving can be shown to be sufficient to pay for installing and operating the necessary superheating devices, it will be extremely difficult to convince a careful street railway manager that it will be profitable to use it.

This is a subject upon which there is a vast amount of conflicting information. In a number of instances the use of superheaters has been discontinued either on account of mechanical difficulties or because there was not a sufficient saving in coal to pay for keeping them in service. In other cases no mechanical difficulties have been experienced, and the saving in coal has been all that could be reasonably expected. It is noteworthy that manufacturers of reciprocating engines and steam turbines, as well as engineers, while still recognizing the value of superheated steam, are disposed to be much more conservative than formerly in recommending its use. At this time, the weight of opinion seems to be in favor of a moderate amount of superheat, say not exceeding 125°. Within this limit there should be a sufficient saving at the coal pile to justify its use, while the temperature is not sufficiently high to cause serious mechanical difficulties with any of the various types of steam apparatus generally used.

For many years after the inauguration of the electric railway industry, power station engineers seemed disposed to devote the greater part of their energies to perfecting the arrangement of engines generators and switching apparatus, frequently neglecting the more important, though less showy, boilers and their accessories. In recent years they have come to realize that a larger percentage of saving can be made by a proper attention to the design and management of the boiler room than in any other department, as it is here that the greater number of preventable losses in a power station occur.

The designs of the standard types of steam boilers which are now generally used have been perfected to such a degree that efficiencies as high as 70 to 75, and even 80, per cent. have been attained under favorable conditions, and there are very few improvements which the power station engineer can suggest which will produce any considerable saving in fuel.

The design of the furnace, as distinguished from the boiler, on the contrary, is one requiring careful thought and study, to make it conform to the conditions required for the perfect combustion of the specific kind of fuel which is to be used. Anthracite coal, owing to its small percentage of volatile matter, can be satisfactorily burned in almost any kind of a furnace, provided the grate area and the draft are sufficient to burn the quantity required to develop the desired capacity, but in the case of semi-bituminous and bituminous coals and lignites, containing a much larger percentage of volatile matter, the furnace should be so designed that this volatile matter, as well as the fixed carbon, will be completely burned in order to develop the full heating value of the fuel.

The principal source of loss is due to imperfect combustion of the volatile gases, which are distilled very rapidly after fresh coal is placed upon the fire, and not being mixed with air at a temperature sufficient to cause ignition, pass off unconsumed, or the air supply and the temperature being sufficient, they are allowed to come in contact with the comparatively cool surfaces of the boiler, and their temperature reduced below the ignition point before combustion is completed, so that they escape when only partially burned. The mixture, temperature and time are therefore important factors in the combustion of the volatile gases, and it follows that the combustion chamber should be of sufficient size to allow the gases to become thoroughly mixed, and that they should be raised to a sufficiently high temperature and be protected by fire-brick walls and arches from the cooler surfaces of the boiler shell or tubes until the combustible portion has been entirely consumed.

A number of furnaces have been devised in which the air has been admitted at the bridge wall or at the sides or front of the furnace above the grate, and there have been many ingenious plans for heating this air to the proper temperature before its admission to the combustion chamber. Some of these furnaces have been fairly successful as a means of reducing the smoke, but it is doubtful if the admission of air above the grate has ever materially increased the efficiency of the furnace. By far the most common practice is to admit all the air through the grate, that required for the combustion of the volatile gases being heated to the proper temperature by passing it through the bed of incandescent fuel.

In many of the larger railway power stations the flue gases are regularly analyzed to ascertain the amount and distribution of the losses due to incomplete combustion and the amount of excess air admitted to the furnace, which information is necessary to enable those in charge to operate the boilers in the most efficient manner. The only way in which the waste which takes place in the furnace can be detected is by such an analysis, and its importance as a means of reducing boiler room losses is so great that it merits a much more general use.

In the combustion of coal the object in view is to produce the highest percentage of carbon dioxide per unit of fuel burned. The higher the percentage of carbon dioxide, the more perfect will be the combustion of the fuel and the higher the furnace temperature, as is shown from the fact that a pound of carbon burned to carbon dioxide will produce 14,600 B. t. u., while only 4,450 B. t. u. will be produced when, on account of an insufficient supply of air, carbon monoxide is formed. The gas analysis will show the percentage of carbon dioxide, carbon monoxide and oxygen. This information will enable the chemist to determine the total heat in the escaping gases, the amount of unconsumed gas, and the losses due to an excess air supply, and will also indicate the cause of these losses and suggest the proper remedy.

A low temperature of escaping gases is frequently regarded as an indication of efficient furnace conditions, but it is quite as likely to be caused by an excess of cold air, due to too strong a draft, uneven fires, or leakages through the boiler settings. The true condition of affairs can only be revealed by means of an analysis of the flue gases. Anything which will increase our knowledge of the conditions which take place within the boiler setting, and will permit a more intelligent use of fuel, should be encouraged, and for that reason the practice of analyzing the flue gases is recommended in all railway power stations where the cost of fuel is an important factor in the cost of power. It is always preferable to have this analysis made by an experienced chemist, but in small stations where the saving to be made is not sufficient to warrant the employment of such a man, it is said to be possible to obtain fairly satisfactory results from the use of one of a number of automatic or semi-automatic devices which are now manufactured for the purpose.

Mechanical stokers are now almost universally employed in electric railway power stations, on account of the increased efficiency over hand-fired furnaces and the reduced cost of operation. In a properly constructed furnace of moderate size, equipped with flat grates, an intelligent and careful fireman will produce results equally as satisfactory as any which have been obtained with any of the various types of mechanical stokers; but the trouble is that such firemen are not plentiful, and it is extremely difficult to secure men who will produce uniformly good results for long periods of time. For this reason the average fuel economy in a railway power station will generally be found to be somewhat better where the firemen are assisted by some form of mechanical stoking device. It should be borne in mind, also, that in order to economize in space and the initial cost of the plant, the size of the boilers and the rate of combustion has steadily increased in the last few years until they have now reached a point where it is doubtful if the larger sizes can be properly stoked by hand, even by the most competent firemen.

There can be no doubt that mechanical stokers accomplish a considerable saving in boiler house labor. A reasonable day's work for a fireman is the shoveling of sufficient coal for about 500-h.-p. of boilers, which in a railway power station will amount to from six to eight tons every twelve hours. Where automatic stokers are used, and coal is delivered to the hoppers by gravity, one man should be able to take care of about 2,000-h.-p. of boilers, which is equivalent to a reduction in labor of 75 per cent. The cost of maintenance of automatic stokers is somewhat greater than that of flat grates, and additional labor is required for repairs as well as for tending the coal handling machinery usually installed in connection with them, so that the net saving in labor will be somewhat less than that indicated above. There is a point, of course, at which this saving is not sufficient to pay for the additional fixed charges and repairs upon the mechanical stoking devices. This point is reached in a boiler plant of about 2,000-h.-p. capacity. In a plant of greater capacity than this automatic stokers can generally be shown to return a sufficient net saving to warrant their use, while in smaller plants it will frequently be found to be profitable to use them on account of the cheaper grades of fuel which can be burned and the greater capacity which can be gotten out of the boilers.

In most power stations records are kept of the coal and water consumption, the temperatures of the feed-water and flue gases, and the station output, by which the performances of the station from month to month can be compared. These records furnish a check upon the condition of the station, the manner in which it is operated, and assure its being maintained in a high state of efficiency. Mr. Bushnell has found that in addition to these records, an occasional test of the entire plant under actual operating conditions for periods of say, 24 to 48 hours, is also of great value as a means of furnishing definite knowledge as to just what the station is capable of doing. Such tests also have a certain educational influence upon the employees, particularly the firemen, as they illustrate to them what can be done when all engaged on the work are exerting their best efforts to secure the most efficient results possible.

At the Rhode Island Suburban Railway Co.'s Manchester St. station all of the usual records are kept, and the quantities and costs carefully determined for each month, and tests of the entire plant are also made as suggested above. This station was originally designed for the Rhode Island Suburban Railway Co. to furnish power for its lines operating in the vicinity of Providence. It was intended to use horizontal units, and two 1,500-kw alternating-current units and one 1,600-kw. direct-current unit were purchased. Before work on the building had progressed beyond the foundations, however, it was decided to increase the capacity of the station by installing two additional direct-current units of 2,500-kw. each. This required a number of changes in the structure, and necessitated double-decking the boiler room in order to provide the necessary additional boiler capacity. The present equipment of the station consists of fourteen horizontal water-tube boilers of 520-h.-p. each, eight on the lower floor and six on the upper floor. The boilers on the lower floor have no superheaters, but those on the upper floor are equipped with internal superheaters, each made up of eighty-four 2-in. tubes, suspended below the boiler drums. The superheaters on two of the boilers were designed for only 125° superheat, and contain 615.3 sq. ft. of effective heating surface each. Those on the other four boilers were designed for 150° superheat, and contain 855.5 sq. ft. of heating surface. Each boiler has 5,159 sq. ft. of heating surface.

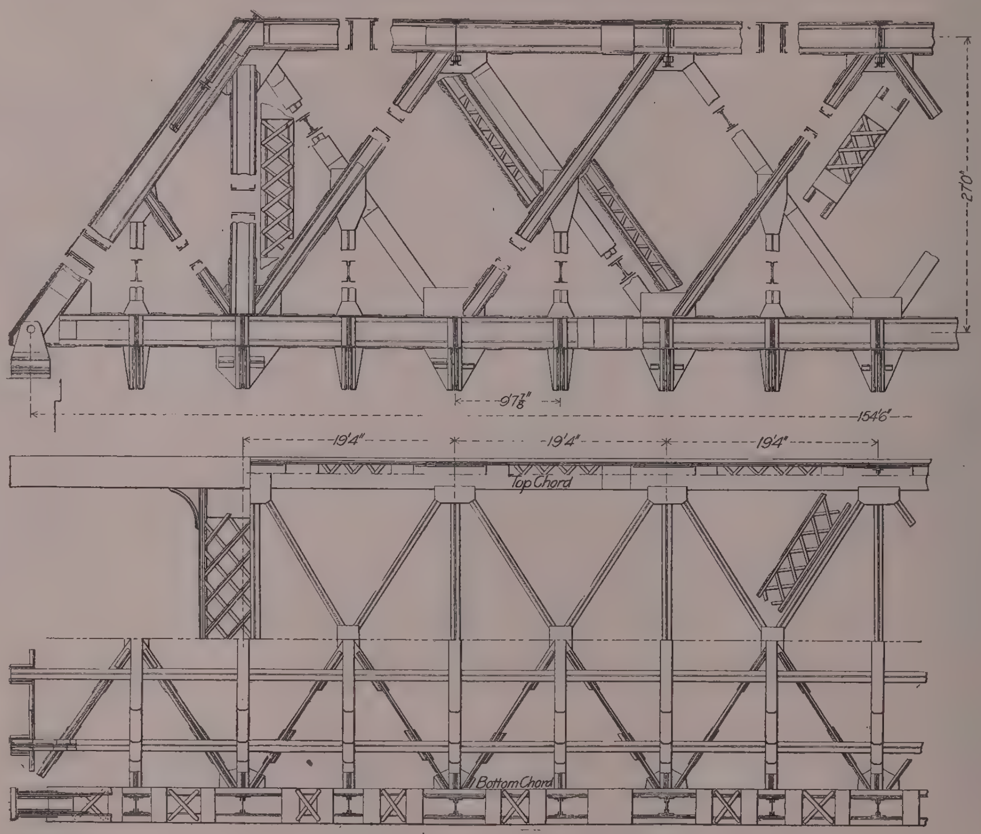
Roney mechanical stokers are used, each containing 112 sq. ft. effective grate surface. A 280-tube Green fuel economizer is installed directly back of each battery of boilers, the flue being so arranged that the hot gases may be passed through the economizers or directly to the main flue as desired. The heating surface per square foot of grate is for boilers 46 sq. ft., for economizers 15 sq. ft., or a total of 61 sq. ft. Natural draft is used. The boiler pressure is 145 lbs. There are three horizontal compound engines with cylinders 32 and 64 x 54 in., operating at 94 r.p.m., and two vertical compound engines with cylinders 42 and 86 x 60 in., operating at 75 r.p.m. All of the engine auxiliaries are steam driven. Jet condensers are used, the air pumps being of the twin vertical type. The average vacuum in the engine cylinders is 25½ in. of mercury. There are two alternating-current generators each of 1,500-kw. capacity, delivering current to the line at 11,000 volts, and one 1,600 kw. and two 2,500-kw., direct-current generators delivering current at 600 volts. The normal capacity of the station, therefore, is 96,000 kw. Direct-current is furnished for 24 hours per day, and alternating-current from 5 a. m. to 1 a. m. There are no feed-water heaters between the engine cylinders and the condensers, but the exhaust steam from the auxiliaries is carried to two heaters located in the basement on the suction side of the feed-pumps. These heaters are made up of horizontal U-tubes arranged in series, the steam entering at the top and discharging at the bottom, while the water enters at the bottom and discharges at the top. Each heater contains 750 sq. ft. of heating surface, and in practice all of the steam from the auxiliaries is condensed and is discharged at a temperature only about 35° higher than the incoming cold water. The average daily output of the station is 102,500-kw-hours.

The following is the performance of the station under actual service conditions from the time it was started in regular service, February, 1904. It should be borne in mind that the first battery of boilers with superheaters was installed eleven months after the station was started, and four months thereafter two additional batteries of boilers with superheaters were commissioned, and the performance of the station is therefore given for the period covered by these different conditions: Eleven months, saturated steam, 2.87 lb. of coal per kw-hour. Four months, slightly superheated steam (no record of temperature kept), 2.73 lb. per kw-hour. Three months, superheated steam, average temperature at engine throttle, 465° (102° superheat), 2.46 lb. of coal per kw-hour. The apparent reduction in coal consumption per kw-hour with steam superheated about 100° is 14.3 per cent., but all of this saving cannot be attributed to this cause. A large part of it is undoubtedly due to the increased efficiency of the fireroom attendants. Probably not over 8 to 10 per cent. should be credited to the use of superheated steam.

Fires Caused by Electricity during the second quarter of this year are classified by the Electrical Bureau of the National Board of Fire Underwriters as follows: Twelve were caused by grounding of circuits, of which four were on gas pipes, the resulting arcs burning holes through the pipes and igniting the escaping gas. Twelve were due to short circuits in service wires. Seven were due to crosses of high and low potential circuits. Seven were caused by uncovered fuses throwing molten metal into inflammable material. Six were due to electrical heaters and flatirons. Seven were due to lightning. Five pole and tree fires were reported. There were 35 other fires due to electrical causes, making a total of 91, with losses aggregating $593,800. Reports of 101 fires, with losses of $2,300,000, cannot be proved due to electricity, although it is probable that this was so in most cases.

A Through-Truss Short-Span Double-Track Bridge.

Bridge No. 1022, on the Berkshire Division of the New York, New Haven & Hartford Railroad, over the Housatonic River, south of Shelton, Conn., has three 158-ft. through riveted truss double-track spans, which are typical of the standard construction developed for that class by the bridge department of that railroad. The bridge is to replace two old single-track spans of the same length, and some of the pile trestle of a former structure on the same site, which was partly destroyed by a recent flood. The river here is subject to sudden freshets in spring which bring down heavy ice at a high velocity. Portions of the old trestle approaches have been carried away several time. The width of unobstructed waterway has been increased when the renewals were made, by successively building one, two and now three spans in the channel, and it is possible that eventually a fourth span replacing the trestle viaduct, which remains on the east side of the river, will eliminate all future danger from ice.



Standard Medium Span Through Truss.

The bridge is designed for heavy train service and high speeds and is proportioned for a train load of 5,000 lb. per linear foot per track, preceded by two coupled locomotives of a total weight of 200,000 lb. and wheel bases of 20 ft. each, including four 45,000-lb. driver axles 5 ft. apart and exclusive of four 28,000-lb. tender axles, 5 ft. apart. All exposed surfaces of the bridge are assumed to be subjected to a horizontal static wind pressure of 30 lb. per square foot, and all train surfaces to a moving pressure of 30 lb. per square foot. The braking of a train is assumed to produce a horizontal longitudinal force due to a coefficient of friction of 0.25 for wheels sliding on rails; 0.03 between planed steel surfaces and 0.05 between rollers and planed steel surfaces. An impact stress of 100 per cent. of the live load is assumed for the floorbeam and track stringer field connections, 30 per cent. is assumed for short vertical members, middle panel web members and counters, and the remainder of the truss members are calculated to receive an addition of 15 per cent. of live load stresses from impact. The weight of each track, above the stringers, is assumed to be 600 lb. per linear foot.

The bridge is built of open hearth steel having an ultimate strength of 56,000 to 64,000 lb. per square inch, and an elastic limit of 55 per cent. of the ultimate, an elongation of 25 per cent. and a reduction of area of 50 per cent. Rivet steel has an ultimate strength of 48,000 to 54,000 lb. per square inch. All angles are capable of being opened flat and those under ⅝ in. thick of being shut close by a hammer without cracking. Holes punched 1¼ diameters from a sheared edge are required to endure drifting to 1½ times their original diameter.

Plates and shapes are proportioned for a maximum tension stress of 9,000 lb. per square inch, net cross-section. Web plates are not considered as transmitting any portion of the flange stresses, and are proportioned for maximum shear not exceeding 7,500 lb. per square inch, nor 10,000 lb. $\div (1 + [d^2 \div 3{,}000\ t^2])$ where d is the clear distance between flange angles or vertical stiffeners and t is the thickness of the plate, both in inches. The maximum stress per square inch in compression members is $8{,}000 \div [1 + (l^2 \div 36{,}000\ r^2)]$ where r is the radius of gyration and l the length of the member between centers of connections, both in inches. Rivets have a bearing stress of 12,000 lb. a shearing stress of 6,000 lb., and a bending stress of 15,000 lb. per square inch. The expansion rollers are proportioned for a pressure of $900 \sqrt{d}$ per linear inch, where d is the diameter of the roller in inches. Bed plates are proportioned to reduce the bearing pressure, including impact, on the masonry to 300 lb. per square inch, for sandstone or concrete, 400 lb. for limestone and 450 to 500 lb. for good-quality granite. Wind stresses are taken one-third larger than the above, all of which conform to the railroad company's standard specifications of 1901.

The trusses are made throughout with riveted members and very rigid connections, having wide and thick double jaw plates and an excess of about 12 per cent. for field-driven rivets. The top chord is 2 ft. 8 in. by 2 ft. 10 in. and has a maximum section composed of two 6 x 4 x ½-in. bottom flange angles, two 4 x 4 x ½-in. top flange angles, two 32 x 9/16-in. and two 22 x ½-in. web plates, and one 34 x ⅝-in. cover plate. It is field spliced in two panels with four web cover plates, a top cover plate, bottom cover plate and four splice angles, as indicated in the detail. Both top chord splices are symmetrical with the center of the span and each has 241 rivets.

The end posts are similar to the top chords and their hip joints are covered by outside splice plates cut to fit between the flange angles of both members. The bottom chord is made of two built channels 34 in. deep and spaced, like those of the top chord, 24 in. apart, back to back. They are latticed on both flanges and the maximum section is made with four 34 x ⅝-in. plates, two 22 x 9/16-in. plates and four 6 x 6 x 9/16-in. angles. Each chord was shipped in three pieces. Each splice has eight web cover plates, one top and one bottom flange cover plate and four horizontal angles. Each has 452 rivets driven, like nearly all the other field rivets, with pneumatic hammers, using air at 100 to 120 lb. pressure, which gives much better results than with pressures of 80 to 90 lb.

All of the truss web members are made of pairs of built channels latticed, or have I-shaped cross-sections made of two pairs of flange angles back to back, latticed and in some cases reinforced with cover plates. One member of each sort occurs in each panel, so that the I-shaped inclined posts pass between the channels of the other at intersections and are field riveted there to the pairs of connection plates which receive the sub-verticals. In the second panel from the end, one diagonal is made of two 20 x 9/16-in. and two 24 x ⅜-in. plates and four 4 x 4 x ½-in. angles, and the other is made of four 6 x 6 9/16-in. angles and two 20 x ⅝-in. cover plates. These members require from 80 to 102 field-driven rivets in each connection to the chords, and the smallest number of rivets in such a connection in this truss is 50.

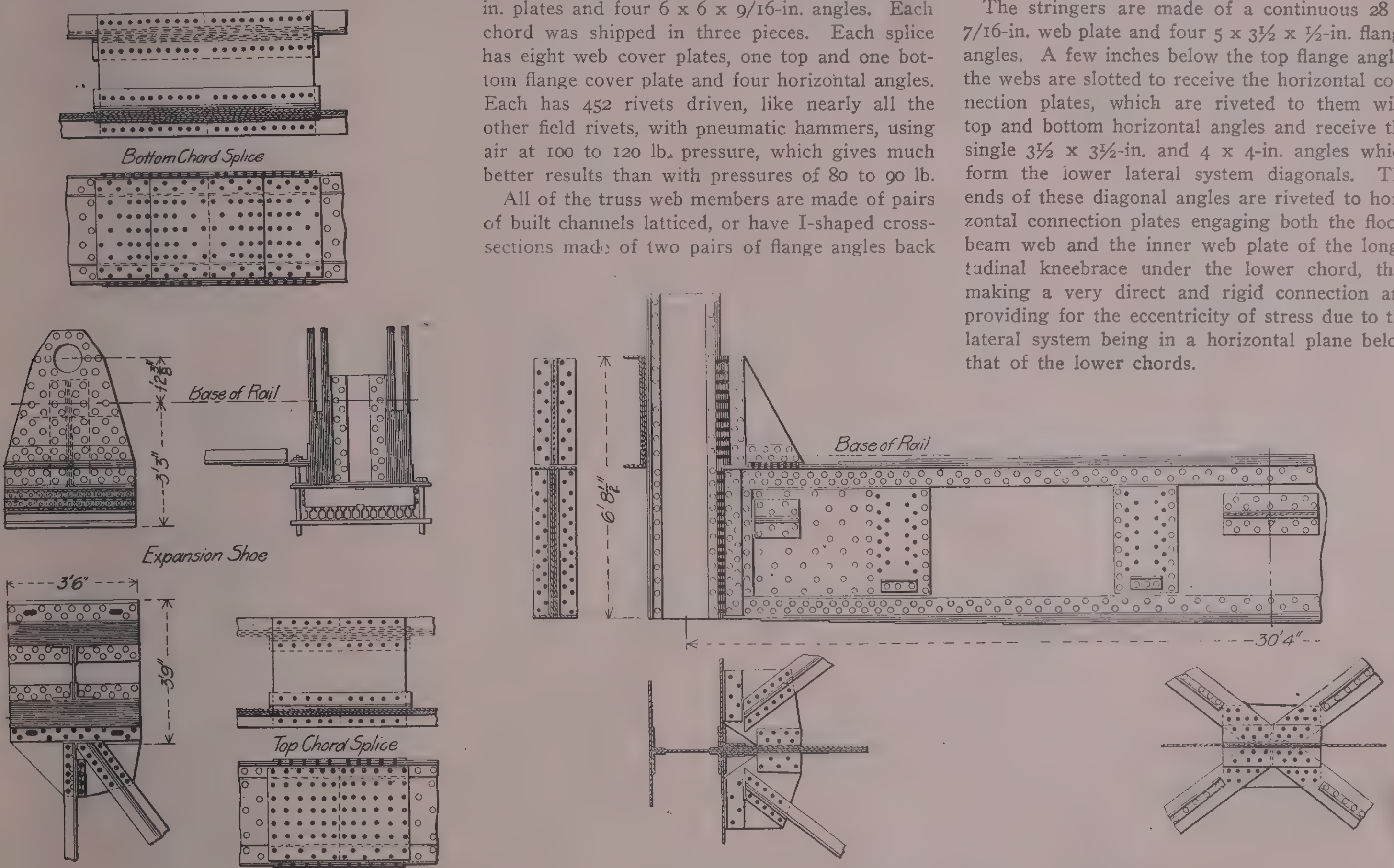
The I-shaped sub-vertical members are made of two pairs of 7 x 3½ x 9/16-in. angles, back to back, latticed, and extend continuously through the bottom chord projecting about 4 ft. below its lower flange and being field-riveted to its web. The projecting portion is very rigidly braced by solid-web longitudinal kneebraces to the bottom chord, and receives the ends of the floorbeams, which are connected to it with 38 1-in. rivets besides 22 more which are in the vertical flange of the transverse kneebrace, field-riveted to the web of the lower chord and to the top flange of the floorbeams. At the main panel points short verticals, like the sub-verticals, are riveted between the connection plates at the feet of the diagonal web members of the truss and project below the bottom chord to receive the floorbeams.

The floorbeams are made of a 46 x 9/16-in. web and two 6 x 6 x 11/16-in. angles in each flange. The top flange has one full length 13 x 9/16-in. cover plate and three shorter 13 x 9/16-in. cover plates. The bottom flange has one 15 x 9/16-in. cover plate and three 15 x ½-in. cover plates. Each end of the floorbeam web is reinforced by two 34 x ⅜-in. plates, and a 34 x ⅜-in. plate is riveted to each side of the web at the stringer connections to reinforce it for bearing stress of the connection field rivets.

The stringers are made of a continuous 28 x 7/16-in. web plate and four 5 x 3½ x ½-in. flange angles. A few inches below the top flange angles the webs are slotted to receive the horizontal connection plates, which are riveted to them with top and bottom horizontal angles and receive the single 3½ x 3½-in. and 4 x 4-in. angles which form the lower lateral system diagonals. The ends of these diagonal angles are riveted to horizontal connection plates engaging both the floorbeam web and the inner web plate of the longitudinal kneebrace under the lower chord, thus making a very direct and rigid connection and providing for the eccentricity of stress due to the lateral system being in a horizontal plane below that of the lower chords.

The shore ends of the stringers have two pairs of vertical web stiffener angles about 2 ft. apart, and there is riveted to the end of the lower flange a 15 x 1 x 24-in. sole plate, bearing between longitudinal guide strips on a 21 x ⅞ x 24-in. bed plate. The shore ends of the stringers are connected to each other and to the shoes of the trusses by transverse struts consisting of a 24 x ⅜-in. web plate and single top and bottom 3 x 3-in. flange angles.

The portal struts are lattice girders 8 ft. deep over all, with T-shaped top and bottom flanges, each made of one 10 x ⅜-in. web plate and two 6 x 4 x ⅜-in. flange angles and having 3 x 3-in. angles for diagonal web members. At each end of the portal there is a short web plate and a solid-web curved-flange kneebrace, affording deep connections to the inclined end posts of the trusses. The top flange angles are continued across the top chords of the trusses and are connected to them by a bent plate. The intermediate trans-



Details of Truss Spans, Bridge No. 1022, Berkshire Division, New York, New Haven and Hartford R. R.

verse top lateral struts are very light lattice girders 4 ft. deep, which are connected to the top cover plate and the web of the top chord and to the inner connection plate for the main diagonals.

The span has bearing on 9-in. pins through the ends of the inclined end posts and lower chords, each of which engages the two double webs of a very high pedestal. Each double web is 6⅛-in. thick over all and is made solid at the bottom with a planed lower edge bearing on the the base plate. The webs are connected by a ½-in. vertical transverse diaphragm and one of them has a horizontal plate connected to it to receive the end lateral diagonal and two of the anchor bolts. At the expansion end the pedestal is seated on a nest of thirteen 6-in. segmental rollers 3 ft. long, with a bed of T-rails having part of each lower flange cut so as to set close together and riveted to a 1⅜-in. bed plate. At the fixed end the pedestal is made 6 in. higher to compensate for the omission of the rollers, but is set on a similar rail bed.

This bridge was designed and built under the direction of the engineering department of the New York, New Haven & Hartford Railroad, Mr. C. M. Ingersoll, chief engineer; Mr. W. H. Moore, engineer of bridges, and Mr. Frederick J. Easterbrook, resident engineer. The weight of one double track span is 500 tons, that of two trusses being 300 tons.

A Cast-Iron Cofferdam.

The three piers of the Grosvenor bridge, a new railway structure across the Thames, near the Victoria bridge, London, have concrete footings carried down in the London clay in open caissons to a depth of about 10 ft. The piers are of composite construction with an 8-ft. concrete footing, a brick base and granite shaft with brick backing. They are adjacent to older piers into which they are bonded in the lower portions, and an opening between the two is spanned at about water level by three T-shaped cast-iron girders about 22 ft. long, enclosed by cast-iron fascia plates in the outer walls, which are surfaced to resemble the coursing of the masonry.

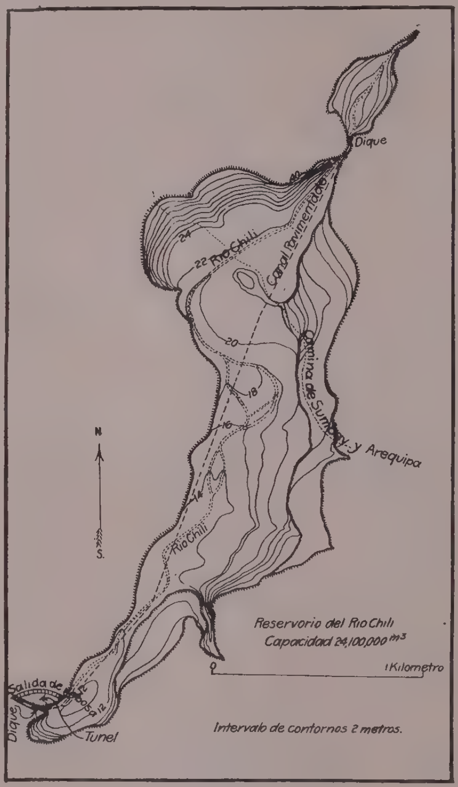
One pier was built in a cast-iron cofferdam 35½ ft. long and 31 ft. wide, with three rectangular sides and a semi-circular end. It was apparently unbraced and was built up with section plates about 4 x 5 ft., with ribbed interior flanges on all sides, varying in thickness from 1 to 1¾ in. The lower eight courses were bolted together and suspended from caps resting on inner and outer guide piles. The suspenders were made with pin-connected 7 x ¾-in. plates with seven screw bearings on the cap plates. As the successive upper courses were built on, additional chains were attached to the cofferdam adjacent to the first and took the weight, releasing the first set which were lengthened by the addition of new links and replaced, releasing in turn the other set, which were similarly extended. The cofferdam was sunk by the aid of divers, jacking and loading, and afterwards was excavated by dredging, the water pumped out and the concrete laid up to the bottom of the third course of plates, above which all the cofferdam was removed after the completion of the pier as far as the ninth course of ashlar and the application of a test load of 1,500 tons of rails. The work is described in detail in a recent issue of "The Engineer," of London.

Steel Tanks for locomotive watering stations on the Chicago, Burlington & Quincy R. R. consist of a large cylindrical tank with elliptical bottom, carried on steel posts, and a central cylindrical enclosure which contains the supply and discharge pipes and protects them from freezing.

Silt in Reservoirs.

By H. C. Hurd, Chief Hydrographer, Peruvian Government.

The problem of handling silt in storage reservoirs seems to be studied less and there seem to be fewer practical examples of attempts at solutions than is the case with other more complicated problems in irrigation engineering. Where the reservoir is situated outside the bed of the main stream, and the water conducted to it by a canal, receiving basins, scouring gates, etc., go a long way toward solving this important problem. There is an excellent example of this in the inlet canal of the Hondo Project, New Mexico, designed by U. S. Reclamation Engineers. But in respect to reservoirs formed by damming up the main stream there seem to be no examples of systematic attempts at a solution, although the danger of the capacity being rapidly decreased by an accumulation of silt is generally discussed and appreciated by irrigation engineers.



The Rio Chili Reservoir.

Of course, large scouring gates are generally provided at the dam, but every engineer of any extended practical experience in irrigation matters, knows that this is no more than a makeshift, and that the effect of these gates is to scour out a funnel-shaped cavity in the immediate vicinity of the gates, in the immense body of silt which covers the bottom of the reservoir and has been growing from the upper end of the reservoir, diminishing the capacity long before ever working down near enough to the gates to be affected by them.

There being such a scarcity of attempts to regulate the silt nuisance, the writer believes that probably a description of such an attempt by him might be interesting. The reservoir which the writer proposes to form by damming a mountain stream is shown in the accompanying sketch. It will be seen that the river runs in a narrow canyon just before entering and just after leaving the reservoir. Also that a short distance above the reservoir the canyon opens out, forming quite a basin. In the narrow canyon just below the basin it is proposed to put in a weir with scouring gates. During the few months of the flood season these gates will be closed forming a small lake in the basin, the flood waters passing through this and over the weir, filling the reservoir. At the end of the dry season after the water has been drawn out of the reservoir these gates will be opened, and the normal or dry season flow of the river, together with the water stored in the basin will be used to scour out the basin. This can be done by diverting it along the edges at first, and not permitting it to cut a deep channel in the silt. The water and silt will run through the reservoir in the paved channel shown on the drawing which cuts off the bends in the river, being shorter and therefore having a steeper grade than the original meandering channel of the river. It is not supposed that in very large floods considerable silt will not be carried over into the reservoir. But it is believed that this arrangement will handle a large amount of silt each year, and in a reservoir as small as this, when the water is very valuable, the amount of capacity saved will pay for the difference, which the peculiar conditions here (a very narrow canyon, etc.) make very small.

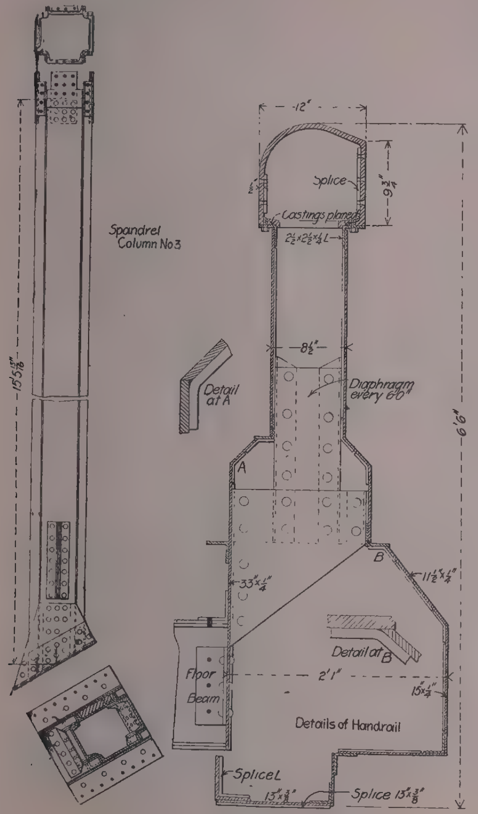
In most reservoirs in stream beds, the first muddy flood waters rush in when the reservoir is low, carrying the silt far into the reservoir and afterwards, as it is filled up, the silt is deposited near the upper end, for, of course, the silt is first deposited when the velocity is first checked. In this project, the first muddy flood waters fill the basin; this backs the water a considerable distance upstream checking the velocity and making the conditions as favorable as possible for depositing silt before reaching the reservoir. At low water the silt can be cleaned out of this small basin a great deal easier than the same amount could be cleaned after being spread over a large area in the main reservoir.

While it is recognized that the special conditions here make this construction cheap, and that the price of irrigated land here is very high (ordinary farms in alfalfa, etc., being worth just about three times as much as the same class in the United States), making water very valuable, and that the steep slopes in this country make reservoir sites scarce, it was thought probable that the principles of this expedient for handling silt might have some general application to irrigating problems, and therefore be of some general interest.

Standardization of Plumbing Fixtures has been undertaken by representatives of the leading water-works of Great Britain, the Royal Institute of British Architects, the British Association of Water-Works Engineers, and the Plumbers' Company. These fixtures are subject to many regulations in Great Britain that are mostly unknown here. They are based on the regulations prepared many years ago by the Local Government Board and now so antiquated that each water-works department has been forced to modify them. As a result a great variation in requirements has come into existence, which is costly to house-holders by preventing the standardization and consequent economical manufacture of fixtures. The work of standardization is meeting with the hearty support of all the interests named. It is particularly instructive to American builders as showing the inconvenience likely to arise if every city attempts to set up its own local standards, like those which the New York Building Department has occasionally attempted to put in force. The Engineering Record does not believe in such regulations for American cities, because their purpose, the prevention of the waste of water, is better served by meters. In Great Britain, however, where any such lavish use of water as characterizes American cities would produce immediate serious troubles, it is considered necessary to allow the use of only strong and durable fixtures and to inspect them frequently.

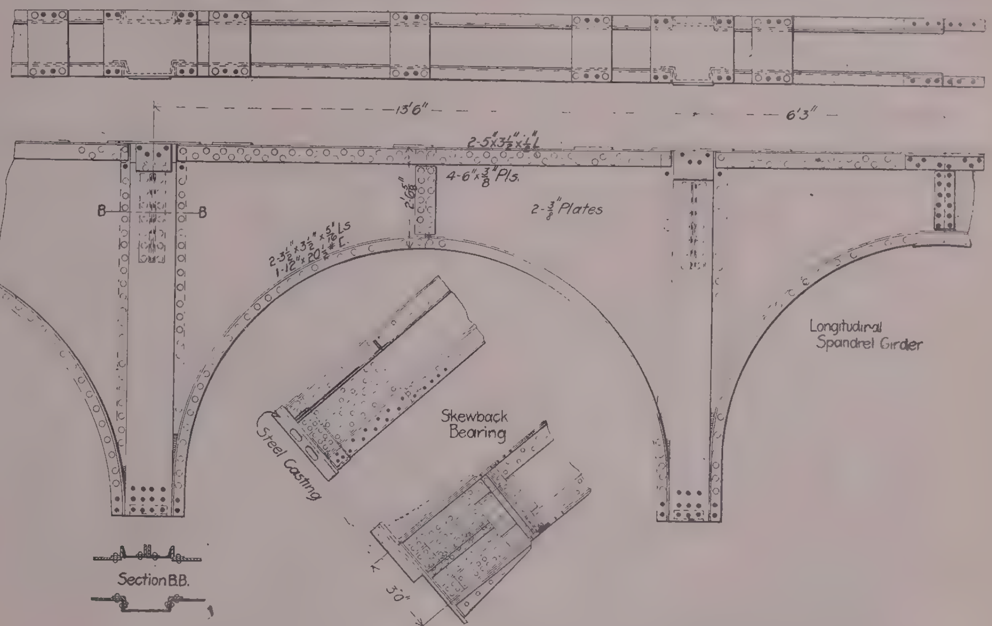
The New Croton Dam Bridge.

The public highway crossing the Croton river and valley on the crest of the great new masonry dam, about 140 ft. above the surface of the ground, is carried by a steel arch span across the spillway at a height of about 100 ft. above the bed of the spillway channel at that point. The end of the main dam and gate house on one side of the spillway, and the retaining wall on the opposite side, form high and massive abutments of ashlar masonry, on which it was at first intended to support a masonry arch. A single span of reinforced concrete was designed, but the plans were superseded by those for the present structure which is a steel arch with two hingeless segmental ribs of 200 ft. span and 43.478 ft. rise. The ribs carry vertical spandrel posts close together with their tops connected by longitudinal members supporting the roadway. The details of these members and the vertical posts are of an unusual character, providing offsets in the front surface and giving an outline similar to that of light masonry spandrel piers and short longitudinal roadway arches. The handrail is of massive box construction, made of solid plates and is intended to conform closely to the appearance of the granite parapet in the same line on top of the dam. The bridge has a heavy concrete arch floor and differs much in general appearance and details from ordinary steel bridge construction. It is of interest on account of the peculiar cross sections of some of its members and the deviations from ordinary practice.



Spandrel Post and Handrail.

The ribs are 18½ ft. apart on centers, have square ends, and are riveted up continuously from end to end, each of them being shipped from the shop in six pieces with field riveted splices at the crown and two intermediate points on each side. They have a closed rectangular cross section which is uniform throughout except that the depth increases from 3 ft. at the skewbacks to 3½ ft. at the crown. It is made with two ½-in. web plates, two 36x⅝-in. cover plates, and four 8x8x⅝-in. flange angles. The webs are connected at panel points by transverse diaphragms normal to the curve and at these points are also stiffened by pairs of outside angles parallel to the diaphragms. Intermediate between these points there are single stiffening angles at two or three equidistant points. Each semi-arch rib is divided by the vertical spandrel posts seated on its top cover plate, into nine panels from 8 ft. long at the crown, to 14 ft. 9 in. at the skewback. The upper edges of the web plates in the semi-ribs are accurately curved to an arc with a chord of 108 ft. 11½ in., and a versed sine of 9 ft. 10 31/32 in. The rib splices are made with milled radial joints and fully riveted top bottom and side cover plates and cover angles. The crown splice is, like the other splices, riveted up solid in the field, but it has a 10-in. pin, with half-hole bearings in the webs of the adjacent rib sections. At the skewbacks the ribs are reinforced by additional web plates, gusset plates and stiffener angles which distribute the pressure on a 39x60-in. base plate at right angles to the line of pressure. The lower half of this plate is seated directly on the masonry, but the upper half is set on a 30x39-in. cast steel bolster 5½ in. thick which was required to fill the space left by an offset in the skewback for a masonry arch bearing. The bolster is planed on both sides and is solid except for two 7½x3-in. holes, parallel to the base plate, which are filled with cement.



Longitudinal Girde and End of Arch Rib.

The spandrel posts have peculiar closed rectangular cross sections made with four channels, three of which have their webs turned outwards, and are riveted together with four full-length angles making re-entrant angles at each corner. All of the posts are 12-in. thick, perpendicular to the bridge axis, the two longest ones are made with two 15-in., 33-lb. channels and two 12-in., 20.5-lb. channels, four 3½x3½x5/16-in. full length angles and four 3x⅜-in. flange fillers. The shorter posts are the same except that the channels are all 12 in. Projecting gusset plates are riveted across the side channels and cast-iron web filler blocks at the feet of the posts and receive extended base plates inclined to match the varying bevel of the arch rib, to the cover plate of which they are riveted. The pockets at the feet of the posts are filled with concrete. The upper ends of all posts are milled square at a uniform height and field spliced with cover plates on all sides, to the principal longitudinal members.

These members are of special design, something like continuous solid-web portals, and serve as roadway girders. They are continuous from end to end of the bridge, resembling, in side elevation, a series of spandrel arches, full centered at the ends and flattened at the crown. They are made with double web plates in the planes of the spandrel post webs, and have top and bottom single outside flange angles. The top flanges are horizontal and are connected only by tie plates 4½ ft. apart on which are seated the floorbeams. The bottom flange angles are connected by curved 12-in. channels, completing the trough-like section and continuing the peculiar side elevation of the spandrel posts around the soffits of the false arches. These flanges are tangent with the sides of the spandrel posts and the web plates are riveted to vertical channels and angles which continue the outlines of the spandrel posts to the roadway level and resemble false piers or pilasters between the spandrel arches. The web plates have milled joints in the center of each panel. These are shop-riveted with cover plates to make sections two or three panels long for shipment. At the upper ends of the false spandrel posts cast-iron capitals are riveted to the web plates. In the center of the arch there are no separate spandrel posts and between the arches the web plates are riveted to vertical angles and Z-bars which practically make columns carrying the floor loads directly to the arch ribs where they are connected with inclined base plates as already described.

The arch ribs are connected at panel points by transverse struts, in planes normal to the arch curve. The panels between these struts are X-braced and both struts and braces have I-shaped cross sections made with pairs of angles back to back, latticed. They are the same depth as the arch ribs and are connected to the latter by top and bottom flange plates and by the web connection angles on the ribs. There is a similar system of top laterals just below the floor, and the spandrel posts are sway braced in single panels except at the ends where there are two panels. All members are made of angles and all connections are riveted.

The hand rail is very stiff and heavy and is made 8 ft. 2 in. high and 2 ft. 1 in. wide, with a very irregular closed section made of solid metal, generally ¼ in. thick. It was one of the most difficult and troublesome riveted members to build that is often encountered in a bridge shop. Except the cast-iron top piece it is made entirely of angles and flat rolled plates, most of the latter having mitred joints with accurately planed edges. The top castings are made in 4½-ft. lengths with faced ends, and all the rest of the pieces are in 18-ft. lengths spliced together with field riveted inside cover plates. The different plates in each section are secured together at the oblique joints by short pieces of bent plates, inside.

The roadway has concrete curbs engaging horizontal angles on the inner faces of the hand rails, and is paved with asphalt blocks 2¼ in. thick, crowned 3 in. at the center and supported on concrete arches 9¾ in. thick at the crown, which are sprung between the floorbeam webs and enclose them completely.

The bridge weighs about 350 tons, and was designed under the direction of the engineering department of the Aqueduct Commission, Mr. J. Waldo Smith, chief engineer; Mr. Albert Lucius, consulting engineer, and Mr. F. S. Cook, assistant engineer, in charge of the draughting bureau. The contract was awarded to the Baltimore Bridge Co., Mr. Nathaniel Haven, president; and Mr. H. D. Bush, manager. The steel work was built in their shops and the contract for its erection was sublet to Mr. S. Fischer Miller and transferred by him to the Miller-Collins Co.

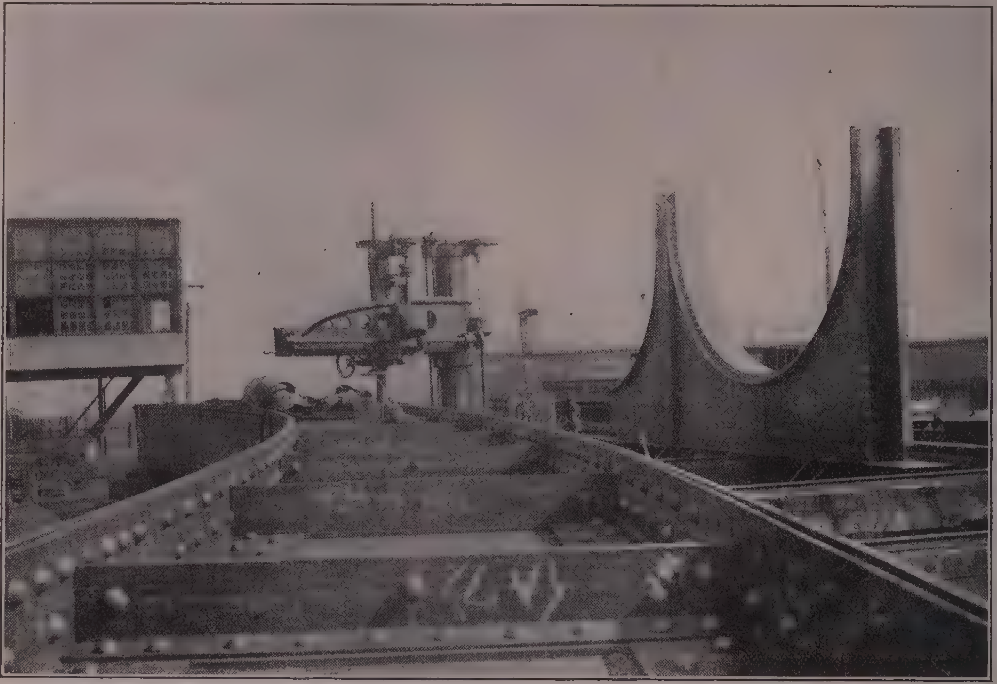
The steel was delivered from the bridge shop by rail to Croton and thence hauled by truck about 3½ miles to a point on the hillside about 20 ft. above the skewback at the north end of the bridge and 70 ft. distant from them horizontally. Here it was unloaded by hand with a stiff-leg derrick with a 40-ft. boom delivering to a truck on a narrow gauge track running to the skewbacks where it was unloaded and usually swung directly to position in the structure by a guyed derrick with a 71-ft. mast and a 65-ft., 20-ton boom seated on top of the north abutment at roadway level. This derrick had one guy 1,400 ft. long and other shorter guys, anchored in the usual way to dead men, as it was not considered safe to trust the small trees in the vicinity to resist the stresses from very heavy loads. A stiff-leg derrick of equal capacity, having a 40-ft. mast and a 65-ft. boom, was seated on the opposite abutment and guyed with back stays only. Each of these two derricks was operated by a 25-h.p. Lambert engine, and was rigged with 6-part wire rope tackles. Considerable difficulty was experienced in locating and operating the derricks and in arranging their guys on account of the numerous derricks previously installed near them by the masonry contractor and the work continually in progress in excavating and building on the bank around the bridge site.

As the bridge axis crosses diagonally over the curved spillway steps and plateau, good horizontal footings were afforded for the falsework, but the heights of the different bents varied greatly, sometimes as much as 25 ft. or more for opposite posts in the same bent. All measurements were made from the existing plans of the Aqueduct Commission and the falsework was cut and framed accordingly. When it was erected the heights proved to be exact for every post but one, thus demonstrating the accuracy of the masonry construction.

The falsework consisted of five equi-distant independent rectangular towers, each with four 10x10-in. hemlock vertical posts in 20-ft. lengths spliced with 3x10-in. yellow pine scabs and ¾-in. bolts. The rest of the material in the falsework was yellow pine, 10 x 10 in. for caps and sills, 3 x 8 in. for struts and diagonals. The tallest vertical post was 115 ft. high. Carpenters could not be procured to build the falsework, so it was framed by bridge men and when practicable the bents were bolted up on the ground and then swung to place; in other cases the single post timbers were set separately. All the falsework timber was erected by the derricks on the tops of the abutments.

A double line of 8x10-in. stringers, 22 ft. long, was laid on top of the tower caps to receive cambre blocking for each arch rib, which was set on pairs of folding oak wedges. The heaviest sections of the ribs weigh 17 tons or more, and like all the rest of the principal bridge members, were erected by the two main derricks on top of the abutments. Each piece was attached to the hoisting tackle of both derricks and lifted from the ground by the guyed derrick, the other derrick at first doing little more than take up slack on its tackle. Then the tackle of the guyed derrick was slacked off and that of the other derrick was taken up until the piece was fleeted or telegraphed to any required point between the two derricks, which in this way commanded the full length of the bridge.

The arch rib bearings on the skewback seats were adjusted by steel wedges about 8 in. long and 2 in. thick, with hooks or shoulders at their thick ends. These wedges were driven around the outer edges of the base plates so as to adjust the latter as exactly as possible in the required position. When the semi-arch ribs met at the crown it was found that at one end of the bridge the base plate for the east side was high and for the west side, low, and at the other end the east side base plate was low and the west side high. These irregularities were easily corrected by driving in the wedges under the low plates, and by driving out the wedges under the high plates, the latter operation being accomplished as readily as the former by driving wedges between the shoulders of the adjustment wedges and the edges of the base plates. Afterwards grout was poured between the masonry seat and the base plate to form the permanent bearing.



Reaming Arch Rib at Shop. Section of Longitudinal Girder on the Right.

The adjacent ends of the semi-arch ribs were at first too far apart at the crown and were drawn together with some difficulty by steamboat ratchets. As soon as the lower laterals were connected up the arch ribs were swung, and afterwards the vertical posts, stringers, etc., were erected, and the floorbeams set as fast as possible so that a Jinniwink derrick could move forward on them and handle the lighter members. After the falsework was completed the bridge was erected by an average force of 35 men in 18 days. All rivets were driven by hand by four 4-men gangs.

The falsework was designed by Mr. E. M. Lee, structural engineer for the Miller-Collins Co., and the erection was under the supervision of Mr. A. M. Haney, superintendent of erection.

Laying Concrete Under Water.

A cut-stone granite masonry dock is under construction at New Rochelle, N. Y., at the corner of a park in the immediate vicinity of the houses of several yacht clubs. The rock foundation on which the dock is built lies at a depth of 14 to 19 ft. below mean low tide and is covered with varying depths of mud. The granite masonry is on a concrete footing which extends from the rock to within 1 ft. of mean low tide and has a batter of 1 to 4 on both faces, except where it is on a shelf made in the rock where the latter is sloping transversely to the line of the dock.

The construction work is carried on in an interesting manner, the concrete of the footing being laid loose under water with the assistance of a diver. The mud was first stripped from the rock with a dipper dredge and the surface of the foundation washed clean by the diver with a hydraulic jet under considerable pressure. The rock has deep, irregular surface fissures in it filled with mud, which were difficult to clean out, but serve to key the footing firmly to the foundation. The concrete is placed in forms built up from the rock the length of the dock on the front face of the footing, and where necessary on the rear face. The faces of the forms are 2x10-in. plank nailed longitudinally to 2x10-in. verticals. A box is made on the outside of the form by nailing a horizontal plank on the bottom and then a second vertical row of longitudinal 2x10-in. plank on the outside of the verticals. This box is filled with enough broken stone to hold the form firmly on the bottom. The forms are made in sections 16 ft. long, and the sections anchored by wire cables near the bottom to the piles of an old dock inside the line of the new one. They are also braced in position at the top by cross pieces nailed to the stringers of the old dock. No attempt is made to level the surface of the rock foundation, and where the forms do not rest evenly on it bags of concrete are filled in the space between the bottom of the form and the rock by the diver.

The concrete is mixed by hand on a derrick scow anchored by the work, and is made comparatively dry in the proportions of 1 of Catskill Portland cement, 2 of sand and 4 of the crusher-run of broken stone, with the pieces extending 2 in. in their greatest dimension screened out. The mixed concrete is shoveled into a ½-yd. bottom-dump Cyclopean bucket, which is lowered into the water by a derrick operated by a Lidgerwood hoisting engine on the scow, and dumped when it is close to the rock, or to the concrete that has already been laid by a line handled by a man on the scow. When the bucket is carefully lowered and dumped practically none of the cement is lost in laying the concrete by this method. The only washing away of cement that is apparent is a small portion that is flushed from the top of the concrete in the bucket as the water rushes in when the bucket is submerged. An extra one-quarter portion of cement is added to the concrete to provide for this waste. The resulting concrete has smooth faces along the forms and appears to be perfectly homogeneous.

The cut-stone masonry rests directly on the concrete footing, and extends to a height of 12½ ft. above mean low tide, with a width of 3 ft. on top, a batter of 1 in. to the foot on the front face and 3 in. to the foot on the back face. A channel, 12½ ft. deep at low tide, will be dredged along the front of the dock, giving a depth of 20 ft. at mean high tide.

The dock is being built by the city of New Rochelle, Mr. Horace Crosby, M. Am. Soc. C. E., city engineer. Mr. F. E. Bradley, assistant city engineer, is in immediate charge of the work, which is being carried on by the Seely-Taylor Co., of New York City.

Completed Span with Part of Hand Rail Assembled, Croton Dam Bridge.

Tower Falsework and Derricks for Fleeting Steelwork to Position, Croton Dam Bridge.

RECENT HIGH-PRESSURE TESTS made on the experimental locomotive at Purdue University by Prof. W. F. M. Goss indicate the inadvisability of working pressures above 200 lb. At 240 lb. serious difficulties were encountered with the operation of the injectors, check valves, etc., while many parts and fittings normally tight at about 200 lb. pressure and less, commenced to leak steam.

Gallery Construction, Christ Church Memorial Building, New York.

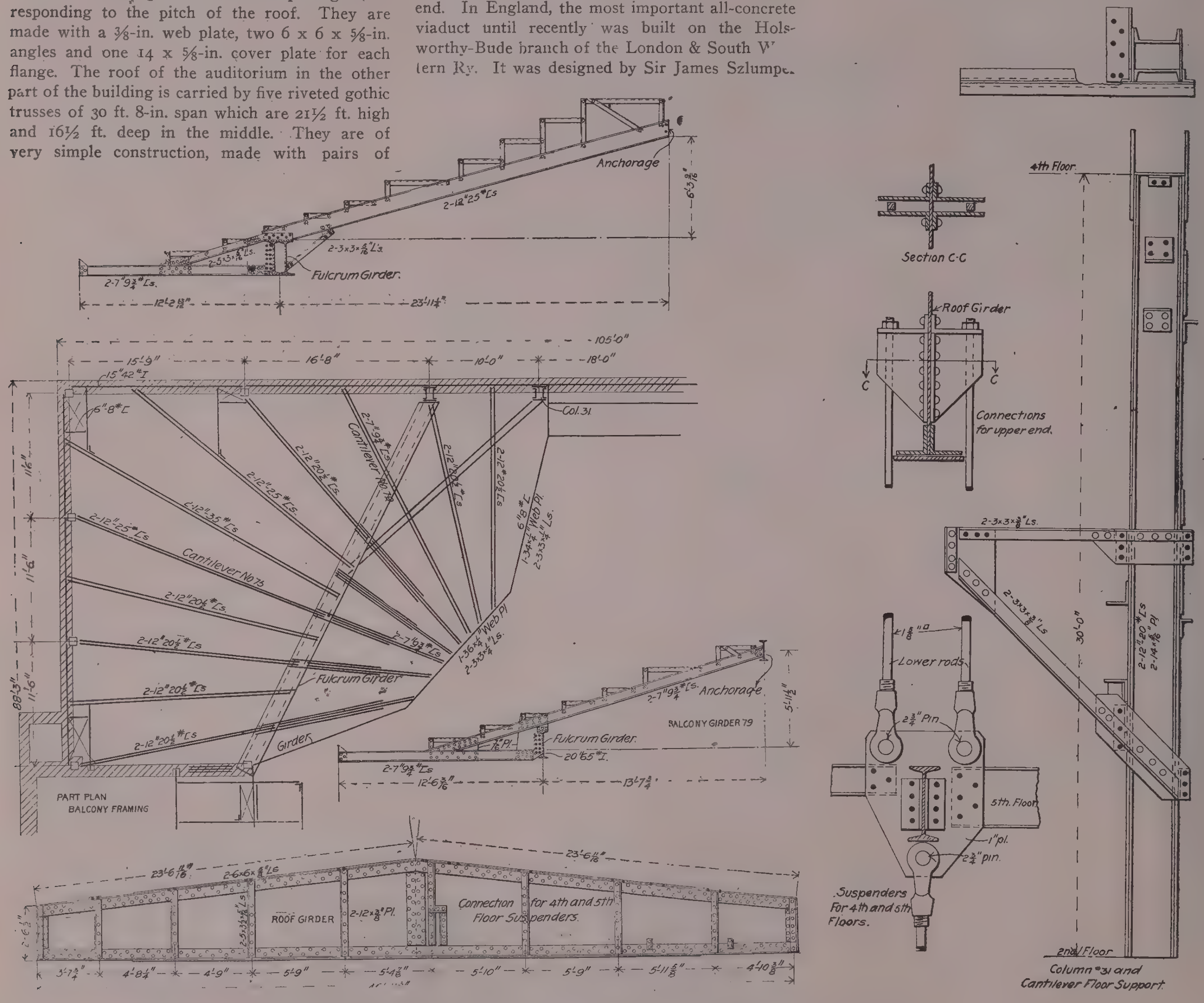
The Sunday School portion of the Christ Church Memorial Building, in New York, is about 105 ft. long and 48 ft. wide. The third floor consists of a balcony with inclined floor, which is supported on girders and cantilever beams arranged as shown in the part plan diagram, which is substantially symmetrical about the center line. The radial cantilevers have their fulcrums on the top flange of a box girder and are anchored by web connections either to the columns or to the wall girders. Their cantilever ends are web-connected to a light plate girder, which carries the ends of some intermediate girders dividing the widest spaces between the cantilevers.

The fulcrum girder, 38½ ft. long, is made with two 24-in., 80-lb. I-beams and two 20 x ¾-in. flange cover plates. The four long cantilevers are made, like the one which is illustrated, with a pair of 12-in. channels back to back with their webs separated ½-in. to receive the vertical and horizontal angles in the platform steps. The lower ends of the channels are bevelled to fit the top of the fulcrum girder to which they are field-riveted between the horizontal upper ends of pairs of bent angles that continue the inclined surface of the top flanges to the outer edge of the balcony. These angles are shop-riveted to pairs of 7-in. horizontal channels and thus make brackets which really form the cantilever arms of the girders and are rigidly connected to the fulcrum girder by field rivets through bent vertical plate connections field-riveted to the girder web. Knee-braces on the opposite side of the fulcrum girder stiffen its lower flange and make the radial girders completely enclose the fulcrum girder, thus affording very rigid connections and economizing headroom.

At one end the distance from the fulcrum girder to the edge of the balcony is considerable, and the fulcrum girder was used as an anchorage and a secondary I-beam girder was run obliquely from it to a wall column to serve as a fulcrum for three short radial girders, two of which do not extend across the main fulcrum girder. These radial girders are light and are made with a pair of 7-in. inclined channels which pass over the fulcrum girder, clear of its top flange and form part of the cantilever bracket, dispensing with the bent angles. They are seated on the I-beam flange with a pair of horizontal flange angles riveted to the notched web plate that engages the bent plate on the I-beam. The two sides of the balcony are structurally separate, but are, for convenience, connected by a narrow floor, which is carried on brackets projecting from the wall columns where the latter receive the auxiliary fulcrum girders.

The two floors above the balcony are supported, in the center, by transverse 15-in. I-beams carried at one end by the wall columns and at the other end suspended from the roof girders by vertical pin-connected rods. At each point a pair of 1⅝-in. rods engage brackets riveted to the webs of the roof girder. Both ends of the rods are threaded; the upper ends have nuts bearing on horizontal angles, and the lower ends have clevises engaging pins through plates web-connected to the floor-beams and girders. The plates also receive the clevises on the upper ends of single 1⅞-in. vertical rods carrying the fourth floor beams.

There are four roof girders, each having horizontal bottom flanges and inclined top flanges corresponding to the pitch of the roof. They are made with a ⅜-in. web plate, two 6 x 6 x ⅝-in. angles and one 14 x ⅝-in. cover plate for each flange. The roof of the auditorium in the other part of the building is carried by five riveted gothic trusses of 30 ft. 8-in. span which are 21½ ft. high and 16½ ft. deep in the middle. They are of very simple construction, made with pairs of angles back to back. The rest of the framework in the building is of ordinary beam and column construction. The total weight is about 400 tons. Messrs. Parish & Schroeder are the architects, Messrs. Boller & Hodge are the consulting engineers and Messrs. Post & McCord are the contractors for the steel work.



Details of Steelwork in the Christ Church Memorial Building, New York City.

Construction by Day Labor is carried on occasionally in Toronto, where the city engineer is a bidder on every paving and sewer contract. When he is the lowest bidder and nobody will take the work at his figure, he has to carry it out by day labor. During 1904, forty-three concrete sidewalks, seventeen paving contracts, one grading contract, and twelve sewer contracts were executed in this way. This plan resulted in a slight saving to the city in the cost of the works.

The Concrete Railway Viaduct at Cannington.

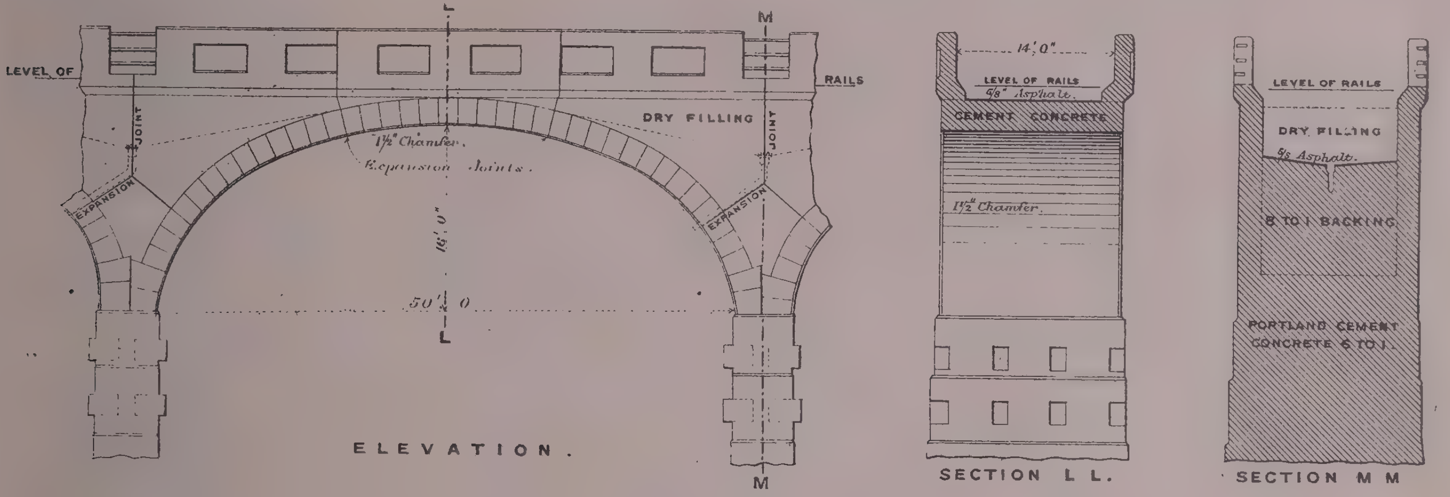
Railway viaducts of large span built wholly of concrete, without reinforcement or stone masonry, are decidedly rare. The largest structure of the kind in the United States is the Riverside viaduct of the San Pedro, Los Angeles & Pacific Ry., described in this journal on September 9 of the current year by Mr. H. Hawgood. This structure has eight semi-circular arches of 86 ft. clear span, and an approach of 38½ ft. at each end. In England, the most important all-concrete viaduct until recently was built on the Holsworthy-Bude branch of the London & South Western Ry. It was designed by Sir James Szlumper and Mr. W. R. Galbraith and has nine semi-circular arches of 50 ft. clear span. This structure has recently been somewhat surpassed in size by the Cannington viaduct of the Axminster & Lyme Regis Light Ry., designed by Mr. Arthur C. Pain and built by Messrs. Baldry & Yerburgh. The following data concerning it are taken from a paper presented to the Institution of Civil Engineers by Messrs. Arthur Wood-Hill and Edward D. Pain:

The Axminster & Lyme Regis Light Ry., a single line whose construction was authorized in June, 1899, begins by a junction with the Yeovil and Exeter line of the London & South Western Ry. at Axminster in Devonshire, and runs southward to Lyme Regis, on the coast of Dorsetshire, the total length being 6¾ miles. The country traversed is very hilly, and the route is largely a contour one. The sharpest curves are 10 chains radius, and the ruling gradient is 1 in 40. The line is laid with 60-lb. flanges on transverse sleepers, to standard gauge. A careful survey of the various routes by which Lyme Regis could be approached suggested the alternative of three small viaducts in the neighborhood of Uplyme, above Lyme Regis, or one large viaduct at Cannington. The latter was chosen, as being the less costly. The Cannington viaduct is built entirely of concrete. It consists of ten elliptical arches of 50 ft. span, the total length of the viaduct being 600 ft., the width over the spandrels 16 ft., and the maximum height to rail-level 92 ft., with a gradient of 1 in 80. With the exception of the concrete blocks used as voussoirs in the outer or vertical faces of the arches, the work throughout is in mass concrete.

The geological strata at the site of the viaduct consist of greensand and blue lias clay. Boreholes were sunk to an average depth of 20 ft. on the site of the foundations of the piers and the east abutment; but on the site of the west abutment, as the foundation appeared solid and firm and was in strong ground, no boring was done, the bottom being tested with bars only. More trouble was experienced afterwards in this part of the foundations than in any other; but it is doubtful whether boring would have given any indication of such trouble being likely to occur. The foundations were originally designed for a pressure of 3½ tons per square foot, but, owing to the soft nature of the ground exposed, it was found necessary to enlarge them, thus reducing the pressure in one case to 1½ ton per square foot. The greatest depth of any foundation was 10 feet, at a pier where a bed of peat was found.

The concrete metal consisted of flints, obtained from two cuttings on the line, cleaned, and crushed to pass through a 2-in. ring. It was found that sufficient grit was obtained by the crushing, and that the addition of sand was unnecessary, except for the face-blocks of the arches and for the comparatively thin work in the parapets. The concrete for the piers (including the bottom plinths), abutments, arches, spandrels and parapets was composed of 6 parts of stone to 1 part of Portland cement. In the foundations of the piers and abutments, and in the haunching of the arches, 8-to-1 concrete was used. The tests of the cement made during the progress of the work showed an average tensile strength of 563 lb. per square inch. The whole of the concrete was hand-mixed, and it was turned over three times dry and twice wet on the stage before being loaded into the skips or barrows.

For hoisting and transporting the concrete, the shuttering, or molds, to the piers and spandrels, and the centering and face-blocks for the arches, a cableway of 1,000 ft. span, with a working-load of 3 tons, was erected across the valley on the center line of the viaduct. The use of the cableway for hoisting and setting the boxes or molds in which the concrete was deposited in the piers rendered it possible to erect the latter without the aid of scaffolding, thereby effecting an economy of both labor and material.



General Form of one of the Arches of the Cannington Bridge

The plinth of the piers above the foundations was faced with flint rubble to obviate the use of splayed shuttering. Above the plinth, the piers were built up in rectangular lifts of diminishing size, instead of having a continuous batter. The lifts were 6 ft. in height, the offset between them being 3 in. at the ends and 1½ in. at the sides. It was necessary to begin most of the piers with a small lift of less than 6 ft., in order to bring the lines of the offsets parallel with the rails and with the springing-line of the arches. The concrete in the piers was deposited in wooden boxes, 6 ft. deep, made of 2-in. tongued and grooved boarding with 6 x 2-in. stiffeners, bolted together with ¾-in. tie-bolts. The boxes were designed so that none of the tie-bolts were built in the finished work. After they had been bolted together on the stage, they were hoisted and set by the cableway, being adjusted to their true position by plumb-lines hung over center-marks cut in the plinths of the piers. The offset occurring at each 6-ft. lift—which was made in 2-to-1 cement mortar—was formed in the bottom of the box. The inside of the box was well soft-soaped before the concrete was put in. The concrete was deposited in 2-ft. layers, 36 hours being allowed for setting between each layer. After the first layer had been deposited, an iron clamp was placed over the middle of the box to allow the bottom row of bolts to be taken out. When these had been withdrawn, the second layer of concrete was deposited; and when this had set, the top row of tie-bolts was taken out and the third layer of concrete was put in. As soon as one box had been filled and the concrete had set, a second box was placed on the top; but the lower box was not removed until the first two layers of concrete had been deposited in the upper one. By this means the upper box was given the support of the lower until sufficient concrete had been deposited to steady the upper box and to admit of its being supported by the projecting offset. For the larger or lower lifts the weight of a box, with its ironwork, was about 2 tons. The first boxes were made with vertical boarding stiffened horizontally; later, the boxes were made with longitudinal boarding, stiffened vertically, which gave more rigidity to the sides, and avoided the fluted appearance given to the face of the concrete by the upright boarding. Besides being checked for line by means of a theodolite, the tops of the boxes were frequently leveled at the four corners, any error being adjusted at once.

Ordinary box-skips, tipped by detaching the front chains and tilting with the back chains, were used for hoisting the concrete. In the upper portions of the piers, where the boxes became too narrow for these skips to enter, hopper-shaped iron skips were used, having a bottom door held by a catch. The usual rate of deposition was 30 cu. yd. per day, which it was found impossible to exceed in view of the confined space in which the concrete had to be deposited, and of the use of the cableway for handling the shuttering and other materials required for the work.

Altogether eleven boxes were constructed, the work in all the piers being advanced at the same rate as far as possible. In the top lift of every pier two rows of corbels were built in to support the arch-centering. These corbels were made in blocks of 6-to-1 concrete and were set by means of the cableway, holes being cut in the sides of the boxes to allow the projecting portions of the blocks to be pushed through. The amount of projection beyond the face of the piers was 8 to 9 in. The corbels measured 2 ft. 9 in. by 1 ft. 3 in. by 2 ft., except the outer corbels of the bottom row, which were made 1 ft. 6 in. in width in order that the exposed sides might be flush with the ends of the piers.

The centering consisted of four built ribs, placed 5 ft. apart between centers, the middle portion of the ribs being tied by a framework supported in the middle by raking struts from the lower corbels. The ribs, including the lattice-work, were built complete upon the ground, and were hoisted into position by the cableway. Four tie-bolts were placed in the span to assist the piers in taking the thrust. The two middle tie-rods were of 1¼-in. round iron, with link-couplings; the two outer ties were made from rails weighing 18 lb. per yd. When depositing the last layer of concrete in the piers, holes were formed for the inner rods by building in a wooden rod, which was drawn before the concrete had set hard. The outer rods passed through the sills, close against the ends of the piers, but did not pass through the concrete.

The faces of the arches were built of concrete blocks, which had been allowed to harden for two months before being placed in position. The blocks are 2 ft. 6 in. in depth by 1 ft. 7 in. in width on the soffit, and are alternately 3 ft. 6 in. and 2 ft. 6 in. in length, forming a toothing on the inside for the mass concrete. With the exception of the middle ten blocks, which are of the same section, every pair of blocks was cast in a separate mold, to suit the curve of the arch. The two similar blocks on the right and left sides of the viaduct were set simultaneously by attaching them in equipoise to the two ends of a piece of flanged rail slung from the hoisting rope of the cableway, and were lowered steadily into position. When molding the blocks, two holes were left in each for the lifting-irons. By varying the lengths of the chains attaching these irons to the ends of the rail, the blocks could be suspended at the angle required by their position on the curve of the arch. This arrangement considerably reduced the labor of handling the blocks, and the two faces of an arch could be set in 2½ days. The weights of the large and small blocks were 17 cwt. and 13 cwt. respectively, which were found convenient in adjustment on the centering. The blocks were jointed in 2-to-1 cement mortar, and were keyed in advance of the mass concrete, in order that the adhesion of the latter to the toothing of the blocks might relieve the centering of some of the weight. Expansion-joints in weak lime mortar were formed between the blocks and in the mass concrete, at the positions indicated in the illustrations. In bringing round the mass concrete, care was taken to form a radiating joint whenever the work was left off. The haunching was completed up to the level of the drainage-grids before the mass concrete between the two expansion-joints on either side of the crown was keyed in.

Four sets of centering were used, the time allowed for the setting of an arch before striking its centering being 3 weeks. In turning the arches, the depression of the centering at the crown was about 2½ in. In spite of its apparent lightness, the centering was found to be sufficiently rigid in all respects, and the setting was greatly facilitated by the ribs being made in one piece. Three-inch cast-iron drain-pipes were built through the arches, a sump being formed in the center of the haunching. The arches were coated with a layer of asphalt, ⅝-in. in thickness, and the inner face of the spandrels was rendered in cement to the top of the dry filling.

The parapets are 18 in. in thickness and 4 ft. 6 in. in height above rail-level, and in order to obtain a clear width of 14 ft., each parapet oversails 6 in. from the face of the viaduct. Panels were formed in the outer face, for the sake of appearance, and to reduce the weight of the walls. Refuges are formed over the center of each pier by a break in the walls, three galvanized-iron bars, 2½ x ½-in. with bent ends, being built in to form a protection flush with the outer face of the wall.

The expansion-joints of the arches and spandrels were continued vertically through the parapets with a V-joint, their positions being made to correspond with the ends of the panels. The expansion-joints, extending, as they do, from the soffit of the arch to the top of the parapet-wall, were found very effective in providing for all expansion or contraction of the concrete, and for any movement due to settlement of the piers; in fact, except in span No. 1, which was affected by a subsidence of the embankment and west abutment, to be described later, no cracks appeared in the work. The maximum opening of any expansion-joint was ½ in.; the majority showed only slight enlargement.

Levels were taken at the ends of the piers to ascertain their settlement. The majority of the piers settled 4 to 6 in., the movement becoming slight towards the completion of the work. These settlements, being fairly even and adjusted as the work proceeded, were not found to affect the concrete; but at the west end of the viaduct the movement was more serious, and trouble arose from subsidence in the case of the west abutment and adjacent pier. Owing to continual heavy rains in the spring of 1903, a slip took place in the embankment, and further settlement of the abutment and pier occurred between March and May of that year. The effect of this subsidence was to crack the crown of the arch, and contractors' traffic over the viaduct had to be suspended. The centering was immediately replaced in spans 2 and 3, that in span No. 1 not having been removed. Raking struts were fixed temporarily from the embankment to the soffit of arch 1, a few feet above the top of pier No. 1, in order to give support to arch 2.

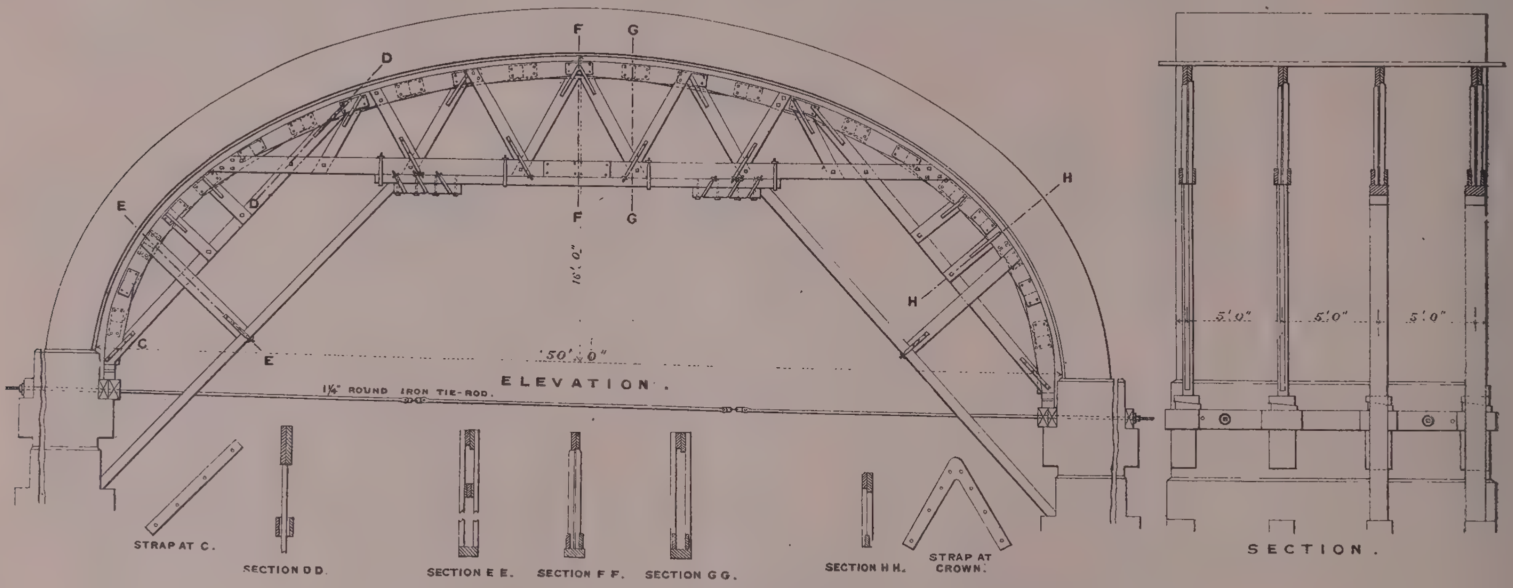
It was decided as a first step to build two diaphragm-walls in span 3, to enable it to act as an abutment, if required. A concrete foundation, stepped at the bottom to suit the difference in level of the piers, was laid in sections between piers 2 and 3, the upper surface being brought to an even slope. The first section of concrete abutting against pier 3 was carried down to the same level as the pier-foundation, but owing to the tendency, when excavating near the bottom of the pier, to draw water and soil from beneath it, the remainder of the concrete was not carried lower than the top of the 3-ft. slab forming the base of the pier. Against pier 2, where the foundation was dry, the concrete was carried to the same depth as the foundation of the pier. The average thickness of the stepped portion of the concrete was 5 ft. 9 in. The diaphragm-walls were 3 ft. 9 in. in thickness and 6 ft. 6 in. apart, and were lightened by two openings, with relieving arches of 30 ft. span. The walls were built entirely of brickwork in cement, in which material they could be constructed more expeditiously than in concrete. As soon as the concrete foundations in span 3 had been completed, two concrete struts 4 x 3 ft. in cross-section, were built in the embankment, between piers 1 and 2, as a support to pier No. 1 against the pressure of the embankment.

Immediately before the completion of the diaphragm-walls, the cracked portion of arch 1 was dealt with. The crown of the arch was cut out between the expansion-joints, *i. e.*, for a length of 18 ft., in widths of 4 ft., and was made good in brickwork in cement. Timber struts were fixed above the arch, for safety, between the expansion-joints of the spandrels, while the damaged part of the arch was being renewed. The faces of the arch where renewed in brickwork, were rendered in cement to match the concrete. In order to reduce the weight upon the crown, the rails and sleepers were laid upon four 54-ft. timbers, 16 to 18 in. square. The building of the parapet-walls over arch 1, and the removal of the centering from spans 1 and 2, completed the work.

The total cost of the viaduct, exclusive of the additional work entailed by the subsidence described, was £10,820, including all labor and materials, establishment charges, and use of plant. Of this sum the concrete cost £10,314, equivalent to an average of £1 12*s.* 1*d.* per cubic yard.

The chief quantities were: Excavation in foundations, 953 cu. yd.; 8-to-1 cement concrete in foundations and in backing to arches, 1,126 cu. yd.; 6-to-1 cement concrete in piers, abutments, arches, spandrels and parapets, 5,303 cu. yd.; dry-stone filling in pockets of abutments and over arches, 1,330 cu. yd.; cement rendering to spandrels, 372 sq. yd.; asphalt, 747 sq. yd.

The viaduct was commenced on September 19, 1900, and the contractors' trains were run over it on October 21, 1902, the work being then finished, with the exception of the parapet-walls. The extra work entailed by the subsidence of the west abutment postponed the opening for public traffic until August 24, 1903.



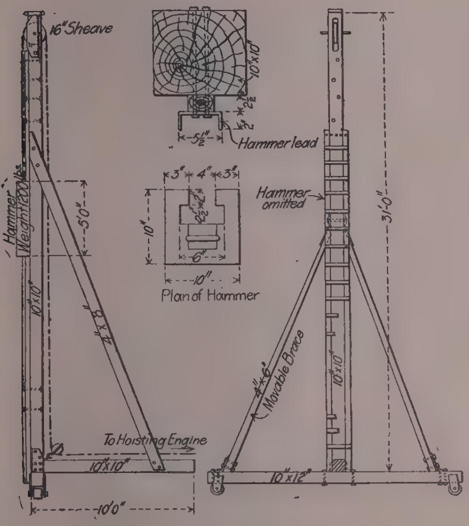
Details of Falsework for the Elliptical Concrete Arches of the Cannington Brid .

Steel Sheet Piling for a Boiler Room Excavation.

The tall steel cage building on lower Broadway, New York, which is now under construction for the Title Guarantee and Trust Co., has, for most of its column foundations, steel I-beam grillages on the fine hard sand about 20 ft. below the curb at the same level as the footings of the adjacent 10 and 12-story buildings. The front and back sides of the lot were enclosed with 3-in. wooden sheet piling and open excavation was made in the usual manner to the general level of the footings but for the boiler room and cold storage vaults with a Broadway front of 73 ft. 9 in. and a depth of 32 ft. it was necessary to carry the excavation 12 ft. deeper. As the soil here is loose, fine sand, with pockets of quicksand, and the excavation extended close to and far below the footings of the adjacent buildings, special provision was necessary to insure their stability. Underpinning and extending them down to the same depth as the new excavation was considered too difficult and expensive, in view of the fact that to underpin to sufficient depth would carry the footings below water into quicksand, and it was concluded to sheet the new excavation so thoroughly that there could be no flow of material into it and no possibility of undermining these adjacent footings. For this purpose permanent sheet piling was required and in order to secure strength and tightness and avoid danger of the formation of cavities by ultimate decay, steel sheet piling was required and the Friestedt Interlocking Channel type was adopted.

The sheet pile units were made with 15-in. channels 15 ft. long which were driven their full length with a 1,200-lb. steam hammer before excavation was made below the general level of the main cellar. As the space enclosed by the steel piles was very much obstructed by the inclined shores from the adjacent buildings and the wooden sheet piling, and by the sidewalk foot bridge on Broadway and its supports, an ordinary steam pile driver could not be made to clear and a special machine was designed and constructed by the contractors which was very light and simple and easily adjustable. It could enter narrow spaces, could reach the extremity of a corner, required only a small ground area for its base, was independently stable or could be rigged with a long narrow sill and guys in one direction only, and was capable of driving piles in contact with the face of the wall without any appreciable clearance.

The pile driver had a T-shaped base with two horizontal stills at right angles to each other supporting a vertical mast at their intersection. The mast was braced by stiff legs to the extremities of the sills and all the connections were made with angle plates and bolts, so that any or all of the stiff legs could be removed quickly and the rear sill could be taken off or the mast could be moved to either end of the front sill to enable it to work in a corner. A vertical channel and separator strip was bolted to the face of the mast forming a guide engaging a slot in the long and narrow hammer. The center of gravity of the hammer was eccentric from the guide, but this did not cause any trouble, and it ran as smoothly with the single lead as ordinary hammers do with two leads. The driver worked very successfully and proved to be well adapted for quick handling among the braces which obstructed the site. It required an engine driver, foreman and four or five men to operate it and handle the piles, and its best record was 16 piles in 10 hours. In difficult conditions the speed was as small as eight piles in 10 hours. It was operated by a single drum Lidgerwood electric hoist and had no difficulty in driving the piles from 4 to 6 in. from the face of the old walls. To drive the piles on the Broadway front the slender mast was allowed to pass up through the floor of the sidewalk bridge where single planks were successively removed to clear it. The machine was designed by Mr. L. L. Brown, of the Foundation Co., who was the contractor for the foundations.



Special Pile Driver

The Penalty Clause in contracts is again turned down by the U. S. Circuit Court of Appeals, 139 Fed. Rep. 248. It rules that in a contract for the building of a structure to be completed by a certain date, a provision that the contractor should be "subject to a penalty" of $100 a day for any delay beyond such time, is not to be construed as fixing the measure of recovery for such a breach, where there is no reason why the damages cannot be ascertained.

Book Notes.

In a little book on "Artificial Stone," there are many statements concerning British experience with this material which are of general interest. For example, it is stated that there are several buildings in London more than half a century old, which are built of concrete blocks. One of these is the house of the Royal College of Surgeons, in Lincoln's Inn Fields, in which the blocks were made of gravel, sand and ground lime, mixed with hot water, and rammed in molds. The most useful part of the book to American readers will be the explanation of the English methods of making artificial stone blocks and slabs for sidewalks. (New York Industrial Publication Co., 50 cents.)

About a year ago Mr. R. A. van Sandick, general secretary of the Royal Institute of Dutch Engineers, made a tour of the Western States for the purpose of investigating American methods of irrigation. Irrigation is an important subject in some of the Dutch possessions, and there is considerable controversy concerning it. Mr. van Sandick sought particularly to obtain information useful in discussing these colonial problems, and in an address entitled "L'Irrigation dans l'Ouest dês Etats-Unis," delivered before the International Colonial Institute, he gave an interesting criticism of our systems from that point of view. Incidentally he summarized the methods and aims of private and public irrigation enterprises in America in an admirable manner, and his address is recommended to European engineers as a fair and comprehensive statement of this work. There is only one feature of our work of which he seems to hold a somewhat erroneous opinion. This is the temporary character of some of the structures. Many of these are inexcusably bad. Others of the same structural character are examples of pioneer engineering of the highest character. They were built under conditions demanding the strictest economy in first cost. It was necessary to raise the money by private subscription among farmers, or by loans at very high rates of interest, and it was inadvisable to erect permanent works until the amount of water available for irrigation was definitely known. In some cases costly permanent works have been built only to prove of comparatively little value because the catchment areas did not supply the amount of water that was anticipated.

Three years ago the directors of the American Institute of Electrical Engineers passed a resolution establishing a Committee on High-Tension Transmission to collect data on line construction, insulators, pins and the like, and the conditions of operation at different voltages and under different climatic conditions; to investigate methods of testing insulators and of regulating voltage, to ascertain the conditions attendant on switching high-tension circuits, and to collect information respecting lightning and static disturbances and the use of grounded protective wires. The committee followed two methods in securing its information. One was to send out lists of questions to the owners of transmission plants and the other was to hold discussions at meetings of the Institute. Each discussion was prefaced by an "introduction" prepared by some member prominently identified with the topic to be considered. These introductions were printed and distributed far enough in advance of the meetings to enable members unable to attend to send in written communications. The information collected in this way was of much practical value, but was scattered through so many volumes of the "Transactions" as to be of relatively little value. It has accordingly been published, with the permission of the Institute, in a single octavo volume of 466 pages. No change has been made in the text and illustrations as they first appeared, except so far as was necessary to co-ordinate the different parts. The value of the information is enhanced by subject and author indices. (New York, McGraw Publishing Co., cloth, $3.00.)

The report on "The Panama Canal," submitted by Mr. Lindon W. Bates, of New York, to the Isthmian Canal Commission, has been published by him in a profusely illustrated quarto volume of about 200 pages. The author's projects for the construction of the great canal were outlined in this journal on April 22 of this year, and gain additional importance from the fact that it is understood some of the greatest financial corporations of this country and Europe stand ready to contract to build the waterway, according to those projects, at Mr. Bates' estimates, which are within the appropriations already made by Congress. The volume contains maps and reproductions of models which give a better idea of the topography of the Isthmus than anything of the sort previously published. The history of the canal to date, the topography, geological conditions and drainage phenomena of the Isthmus, the problems of harbor construction and maintenance at the termini, and the size of vessels which should be adopted in establishing the canal prism are all taken up in detail. The author then discusses the various features of his projects, illustrating the types of structures selected for them by reference to many important works of a similar character. Special attention may be called to the section of the report relating to the financial aspects of the canal situation and to the way in which the Bates projects harmonize with them. It is unfortunate that few engineers seem to have the ability to present cost data in such a way as to be clear to a non-technical reader, and the author's statement of the financial side of his projects is so clearly and definitely made that it deserves careful study as a model of such work.

Commercial Economy in Steam and Other Thermal Power Plants. By Robert H. Smith. Philadelphia, J. B. Lippincott Co.; cloth, 8vo, $7.

Prof. Smith is one of the cleverest expounders of scientific engineering in England, as this book will convince the reader not already familiar with his writings. It is really a plea for sound business principles in the selection of a power plant, and begins with an explanation of what economy really is in such an installation. Unfortunately, the author employs so many scientific words in place of the customary English terms that his meaning frequently needs elucidation by the unabridged dictionary, which, indeed, is often silent concerning some strange expression. Those who are not daunted by this serious defect will find much to repay them. His explanation of the economical effect and importance of all the large and small parts of a power plant is very interesting, and his method of ascertaining the highest economy of a given plant, or of selecting component parts to secure the most economical plant is decidedly important. The same is true of his solution of many problems involving a number of variable factors.

A valuable feature of the book is a large number of diagrams prepared by Mr. H. Malcolm Hodson. These cover a wide range of subjects, both engineering and financial. Some of them give the cost of various kinds of power plants, steam, gas and oil, and others give their annual charges. Unfortunately most of them will have to be used with great caution by American readers, because there seems to be no fixed ratio between the items making up these costs in the United States and Great Britain. Other diagrams, however, such as those showing the pressure, temperature, volume and entropy of steam, will be directly useful to all readers.

THE DESIGN AND CONSTRUCTION OF METALLIC BRIDGES.—By Wm. M. Burr and Myron S. Falk, New York, John Wiley & Sons; cloth, 8vo., pp. 546, $5.00.

A few weeks ago Messrs. Burr and Falk's "Graphic Method by Influence Lines" was noticed in this journal, and it is now possible to review its supplementary volume. This is a discussion of the principles underlying the design of all types of trusses used to any material extent in American bridge practice, and also for roofs, a fact hardly covered by the title. These two volumes cover the field of Prof. Burr's work on "Stresses in Bridge and Roof Trusses, Arched Ribs and Suspension Bridges," except the portions relating to arches, suspension bridges and other statically indeterminate forms, which will be taken up in a third volume to be issued at an early day. It may be said, in a general way of the volume under review, that it contains those parts of the general field of bridge design which are most essential to the average engineer, and can be used without trouble by those unfamiliar with the authors' "Graphic Method."

The introductory chapter giving a historical sketch of bridge building brings together in concise form the main facts of the subject. It is to be regretted, however, that the types of trusses named after the early American bridge designers are not carefully defined. In some cases the reader is left to form his own opinion of the characteristic features of a type from an outline diagram. This must be quite a handicap to the student, for the references in many parts of the book to types of bridges nowhere defined must cause confusion. Following this historical introduction is a valuable summary of present standard practice as regards types of trusses, loads and specifications. This chapter furnishes the data on which the bridge designer bases his work, and is particularly important as a concise statement of the requirements of the leading American specialists for railway and highway bridges.

In order to make the volume useful to those who do not possess its companion treatise, the authors give two strictly theoretical chapters. One of them is a brief statement of the subject of influence lines and their use for determining moments and shears in beams and trusses, including an explanation of the application of influence-line methods to trusses. The other theoretical chapter explains the methods of deflections and least work and their applications. These methods are now coming into use so rapidly that the designer of swing bridges, for example, who still adheres to the theorem of three moments for all cases, is likely to regret it before long. It is possible, indeed, that the authors do not lay sufficient emphasis on the value of influence lines for solving many problems lest they seem to advertise unduly their treatise on the subject.

The remaining chapters of the book are distinctly practical. Moments and shears, the design of plate girders, trusses with parallel horizontal chords, non-continuous trusses with non-parallel chords, swing bridges, wind stresses and details of construction, are taken up in the order named, and illustrated by examples drawn from recent practice by the best designers. The latest methods of computing stresses as well as the firmly established older ones are employed, and some old or unusual forms of trusses are analyzed in order to make the book complete. The authors' desire to make their work as helpful as possible is shown by the care with which all such rare or obsolete topics are so designated, thus freeing the book from the unbalanced historical perspective which is not uncommon.

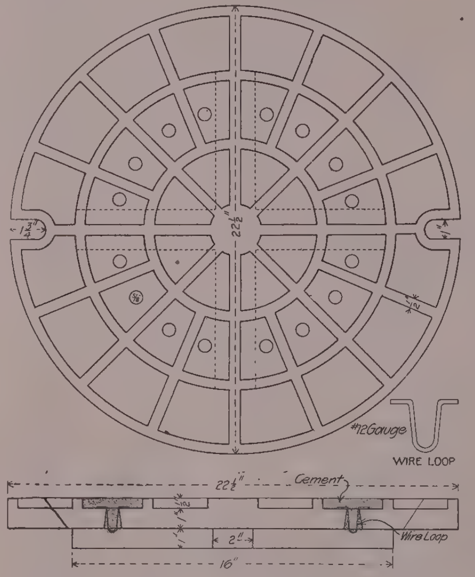
Letters to the Editor.

BEDDING HEAVY BRIDGE PEDESTALS.

SIR: With regard to a suitable material for bearing joints between metal and masonry, I think the following extract from a letter recently received from Mr. James E. Howard, of the Watertown Arsenal, covers the ground quite fully and correctly:

"No direct experiments have been made here on material for joints between base castings and masonry for bridge work. The data referred to in the article in The Engineering Record were doubtless general results on some of our stone tests in which cushions of different kinds have been tried.

"Neat Portland cement is the best facing for stones tested by compression, next to strictly flat surfaces, where no cushion is needed. If it is practical to bed metal work on a layer of neat Portland cement or 1:1 mortar, I can hardly think of a better cushion. In standpipe work I believe it is customary to lay the bottom plates directly upon some loose dry cement, depending upon the latter to take up the necessary water for hydration and set in shape, exactly filling the inequalities of the foundation courses of the masonry and the steel plates. Our tests on cement set under high pressures, 15,000 lb. per square inch, have shown an enormous gain in strength over cement tamped into a mold. We have reached a crushing strength of 19,000 lb. per square inch on a thirty-day test with Portland cement so treated. Hence the immediate lowering of a heavy casting should be quite beneficial to a layer of cement and its final strength is certainly very great.



Method of Closing Holes in Manhole Covers.

"In regard to the effect of prolonged pressure on lead, it will continue to flow under comparatively low pressures for several months. A test of this kind was made in which the initial pressure was about 2,000 lb. per square inch on a small cylinder ¼-in. in diameter. The weight was constant (100 lb.) and the cylinder continued to shorten for a period of eight months. The sectional area increased in the meantime so that the pressure was reduced to less than half the original intensity, or something less than 1,000 lb. per square inch.

"The question of the durability of steel or iron in contact with lead, impresses me as one of importance. Iron stanchions in masonry which have had lead poured about them eventually waste away. The action is probably a galvanic one, iron being susceptible to such action in the presence of moisture. However, a long interval of time might be needed to effect any substantial injury.

"The use of canvas has not suggested itself as a cushion in the testing of stones. Its value would seem to rest on its low modulus of elasticity under compression stress, if it can be spoken of in this way, rather than possessing the ability to equalize pressure by filling interstices and moving away from the parts most strained. And while cotton duck does not at once commend itself for an immediate test, it might seem less advantageous as a filling in a permanent joint. I should hardly think any material of vegetable origin would be suited for such a place; that painting might not be effective against decomposition ultimately taking place."

I would recommend very accurate tooling of the masonry surface and a thin wash of neat cement grout applied just before the metal shoe is placed.

The use of lead is in some respects theoretically bad, but I know of no case where in practice it has failed to attend to its business properly. The loads under which it will flow to an objectionable extent are far in excess of what will be found in practice. In event of excessive bearing coming at any point the lead will flow and cause a certain equalization of the load which would not occur with an unyielding joint.

I have understood that in testing stone blocks to destruction in some cases lead cushions gave lower strengths for the stone than asbestos sheets. I should consider asbestos sheets distinctly better than canvas in practice, because the former will certainly not change with time.

Rust joints are, I think, undesirable and unnecessary. While I do not know a case of failure in this kind of joint, it is difficult to make, slow to set up, and invariably discolors the masonry. If a thick joint is necessary, one-to-one cement mortar, dry enough not to flow under the ramming, when thoroughly rammed will, I believe, be superior to any other form of thick joint.

Yours truly, R. S. BUCK.
New York, Oct. 9.

CLOSING PERFORATIONS IN MANHOLE COVERS.

SIR: In your issue of Feb. 11, a method was described for closing the perforations in manhole covers. Finding it necessary to do some work of this kind in order to keep a heavy flow of surface water out of a system of sewers whose capacity was limited, the following method was devised and has proved very satisfactory. It has the advantage over the plan before described in requiring no special castings, but can be used on any cover. Pieces of stiff iron wire are bent to the shape shown in the drawing. These are inserted in the cover perforations, with the loops downward, and held in place temporarily by a flexible wire attached to the loops. The holes are then filled with Portland cement, which, on setting, is held firmly in place by the imbedded wires. The spaces between the upper ribs of the covers are also filled with cement, protecting the ends of the wires. By means of a circular iron framework to which the temporary wires can be attached, all of the perforations can be filled at one operation. The cement should, of course, be allowed to set thoroughly before replacing the cover.

Respectfully, EDWARD S. RANKIN.
Newark, Oct. 10.

A 9,000-H.-P. TANGENTIAL WATER-WHEEL is being built for the de Sabla power plant of the California Gas & Electric Corporation. It will operate under a head of 1,530 ft. at 400 r.p.m., and will be driven by a single jet of water. The same makers, the Abner Doble Co., have furnished four similar wheels of somewhat smaller capacity, 8,000-h.-p., to this corporation.

CURRENT NEWS SUPPLEMENT

OCTOBER 21, 1905.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Chas. Warren Hunt, 220 West 57th St., New York. Next meeting, Nov. 1, paper on theory of building frameworks.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, F. R. Hutton, 12 West 31st St., New York.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 95 Liberty St., New York.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, W. H. Merrill, Jr., Chicago.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, R. W. Raymond, 99 John St., New York.

AMERICAN INSTITUTE OF ARCHITECTS. Secretary, Glenn Brown, Washington, D. C.

ASSOCIATION OF ENGINEERING SOCIETIES. Secretary, Frederick Brooks, 31 Milk Street, Boston, Mass.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, W. M. Mackay, 235 Water St., New York.

CANADIAN SOCIETY OF CIVIL ENGINEERS. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

AMERICAN PUBLIC HEALTH ASSOCIATION. Secretary, Dr. C. O. Probst, Columbus, O.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. Secretary, S. F. Paterson, Concord, N. H.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

AMERICAN WATER-WORKS ASSOCIATION. Secretary, J. M. Diven, Charleston, S. C.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Richard Moldenke, P. O. Box 432, New York.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

AMERICAN PUBLIC WORKS ASSOCIATION. Secretary, W. H. Flint, Chattanooga.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, H. W. Ross, Room 806, 258 Broadway, New York. Annual meeting, Dec. 4-5; 12 West 31st St., New York.

NATIONAL ASSOCIATION OF MANUFACTURERS OF SAND-LIME PRODUCTS. Secretary, H. A. Duerr, Wilmington, Del. Next meeting, Dec. 5-7, Detroit.

NATIONAL ASSOCIATION OF CEMENT USERS. President, Richard L. Humphrey, Harrison Building, Philadelphia, Pa.

THE INTERNATIONAL EXPOSITION AT MILAN.

In order to celebrate appropriately the completion of the Simplon tunnel, an International Exposition under Royal Patronage will be held in Milan from May to November, 1906. It will be the largest European exposition ever held outside of Paris. Practically all of the European countries will participate officially, as well as several of the Asiatic nations.

In the transportation section, retrospective exhibits will show the historical development of the various methods of travel. The dominant feature will be Motion. All products, as far as possible, must be shown in connection with the processes, thus filling the halls with *live* exhibits. Arrangements will be made for field tests and competitive trials in all classes where it is expedient. An especial feature will be the automobile display to which an entire pavilion will be devoted. This show will terminate in mid-summer so that machines exhibited may be sold for early delivery.

The great success that attended the Turin Exhibition of Decorations has prompted the Milan authorities to set aside a special pavilion for decorative arts. They are very desirous to see the United States well represented in the section.

One large building will contain all forms of welfare work, grouped under the several heads; Mutual assistance and insurance, co-operation, savings institutions and popular credit, protection of labor and insurance against enforced idleness.

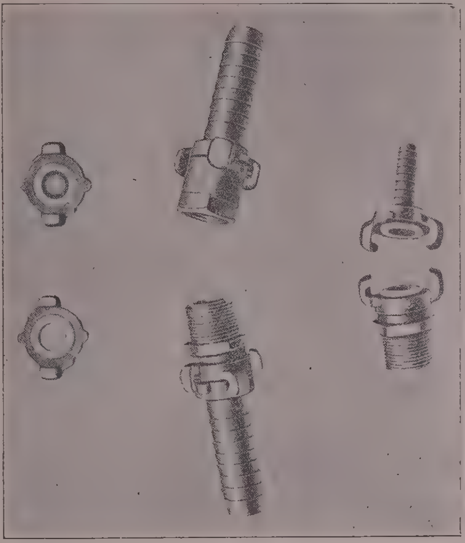
Milan is the center of the most productive section of Italy. Its population is one and a half million, while Lombardy, no part of which is more than three hours distant, has nearly five million inhabitants. Genoa, the port of entry, is less than one hundred miles distant. The cost, therefore, of transporting exhibits from the United States will be comparatively cheap.

Owing to the fact that a large proportion of the Italian labor is employed in the shops and factories, there is available only a small number of food-producing workmen. This makes it imperative that supplies be secured from abroad. The authorities of the Exposition recognizing this condition will inaugurate about June 15, a special Food Show. It will be well for the American producers of food stuffs to profit by the opportunity to display their products.

Further information concerning the Exposition can be obtained from J. H. Gore, George Washington University, Washington, D. C., or L. S. Ware, 54 Rue de la Bienfaisance, Paris, France.

A NEW AIR HOSE COUPLER.

The "Chicago" hose coupler was designed to meet a demand for a universal coupler whereby a plant once standardized could thereafter be maintained standard without extra expense for specially constructed couplers to suit various sizes of hose used with pneumatic tools. By reference to the illustration it will be observed the Chicago coupler has no male or female part at the coupling end proper, but instead, each half has both male and female features, whereby each is exactly the same and will couple regardless of the style and size of the shank. It will be seen that quarter-inch hose may be coupled to three-quarter-inch hose, one-inch pipe, or anytning having one of the couplers attached to it.


THE CHICAGO AIR HOSE COUPLER.

The shanks are manufactured for pipe male thread, pipe female thread, and hose in standard commercial sizes one-quarter inch up to one inch, which enables all couplings to be made without resorting to reducers or special shanks to meet the conditions presenting themselves where pneumatic tools are in use. These couplers are manufactured by the Chicago Pneumatic Tool Co.

INCREASING DEMAND FOR LARGE GAS ENGINES

An interesting demand for the gas engine of large size is noticeable, due no doubt to greater appreciation of the excellent operating economy of this class of prime movers. The Westinghouse Machine Co., of East Pittsburg, Pa., the first manufacturers of large gas engines in America, have received within the last few weeks many orders for gas engines, ranging from 10 to 1,000 B.h.p. No less than thirty-six gas engines are covered by these orders, aggregating 6,647 B.h.p.

One of the most recent and significant orders was received from the Rockland Electric Co., of Hillburn, N. Y., for two 500-h.-p. double-acting horizontal tandem gas engines. This company has already in operation three 19 x 24-in. Westinghouse double-acting gas engines direct-connected to generators, and this second order serves as a testimonial of their satisfaction with the use of gas engines as prime movers.

Another order worthy of special mention is one from The Union Traction Co., Independence, Kan., for one 500-h.-p. horizontal tandem gas engine and one 1,000-h.-p. horizontal twin tandem gas engine, both for alternating current generator driving in parallel. Other orders were received from the Sherwin-Williams Co., Newark, N. J.; American Sheet & Tin Plate Co., Pittsburg, Pa.; The Sidney Electric Light Co., Sidney, Ohio; J. C. Sterns Electrical Co., Buffalo, N. Y.; American Snuff Co., New York City; Northwestern Lithographing Co., Milwaukee, Wis.; Granite City Hospital, Granite City, Ill.; American Locomotive Works, Allegheny, Pa.; American Acid & Alkali Co., Bradford, Pa.; Amolyo Mining Co., New York City; Home Light, Heat & Power Co., Pittsburg, Kan.; Pittsburg, Pa., City Hall; Dr. C. F. Bingham, Pittsburg, Pa.; Automatic Electric Co., Chicago, Ill.

THE IRON AND STEEL TRADE.

The situation in the iron and steel trade up to the middle of the week was summarized in the "Iron Age" as follows:

The leading interests in the steel industry are more and more emphatically taking a position adverse to any violent upward price movement. They are endeavoring to keep not alone values of raw material within bounds, but are holding down prices on finished iron and steel. This is shown by the character of the buying of pig iron, on the one hand, and by the success in keeping the official price of plates at the old figure. The markets for pig iron have stiffened. This week it is the East and the Central West which have marked up quotations. Some of the large Southern interests have practically withdrawn from the market entirely, but there is still some, though little, iron available on the basis of $12.50 for No. 2 at Birmingham. In the Central West the news of greatest interest is that the Steel Corporation has purchased 80,000 tons of iron for October delivery at $15.50 at furnaces and 20,000 tons for November delivery at $16, thus establishing an advance. The quantities purchased, however, are smaller than expected. There has been further good buying in the Eastern markets, and prices have been advanced from $16.50 to $16.75 at furnace for No. 2 foundry, and $17.50 to $17.75 delivered for basic pig. A leading Buffalo interest has to-day put up prices 50 cents a ton. The reaffirming of the official price of $23 for steel billets by the makers interests nobody, since the "official price" has long since been inoperative. What transactions have taken place during the last few months have been at considerably higher figures. In the Eastern markets very considerable quantities of open hearth steel have been selling lately at $28. A number of moderate sized lots of steel rails have been contracted for during the last week. It is understood that thus far the New York Central Co. has allotted about 125,000 tons of its requirements, and that the Baltimore & Ohio Co. is in the market for 71,000 tons. The pressure upon the car builders and locomotive shops is enormous. It is figured out that there are contracts in sight for 80,000 steel cars, which include the 20,000 cars just being figured on for the Pennsylvania system. The locomotive builders are crowded, and are covering liberally for their materials. One large interest has contracted for a total of 75,000 tons of bars, plates, etc. Reports from the lighter lines are very encouraging. Even in the tinplate trade orders and specifications are on a more satisfactory scale.

INVESTIGATIONS OF THE FIRE RESISTANCE OF CONCRETE.

Investigations of the fire-resisting qualities of cement mortars and concretes will be made under the joint direction of the American Society of Civil Engineers, American Society of Testing Materials, Joint Committee on Concrete and Reinforced Concrete, National Association of Cement Users, National Board of Fire Underwriters, National Fire Protection Association, Association of American Portland Cement Manufacturers, Concrete Block Machine Manufacturers' Association, United States Geological Survey. The origin of this investigation is very interesting as showing the widespread recognition of the importance of the subject.

The question of the fire-resisting qualities of structures in which cement is used as a binder has been claiming the attention of all constructors for many years, but more particularly since the Baltimore fire. Some experimental work has been done which has given useful information on the subject. The program for the investigation of fuels by the United States Geological Survey includes tests of the fire-resisting qualities of cement mortars and concretes; it has been proposed to carry on similar studies under the joint direction of the National Board of Fire Underwriters at the Underwriters'

Laboratories in Chicago. The Joint Committee on Concrete and Reinforced Concrete of the American Society of Civil Engineers and affiliated societies, the National Association of Cement Users, the Association of American Portland Cement Manufacturers and the Concrete Block Machine Manufacturers' Association also contemplated making similar investigations.

In order that these tests should be as exhaustive as possible it was deemed inadvisable for the various organizations to proceed on independent lines, but to unite in a joint investigation. In response to a call by Mr. Richard L. Humphrey, representatives of the various organizations met at the house of the American Society of Civil Engineers, on Sept. 5. There were present representatives of the American Society of Civil Engineers, American Society for Testing Materials, National Board of Fire Underwriters, National Fire Protection Association, National Association of Cement Users, Association of American Portland Cement Manufacturers, Concrete Block Machine Manufacturers Association and the United States Geological Survey.

The object of the meeting was explained and after some discussion it was decided to organize a committee for the joint investigation of the fire-resisting properties of cement mortars and concretes by the above-named societies. The committee organized by the election of Mr. Richard L. Humphrey, chairman, and Mr. Robert W. Lesley, secretary pro tem. A plan for the proposed investigations was submitted by the chairman and was discussed at length and as amended was adopted as follows:

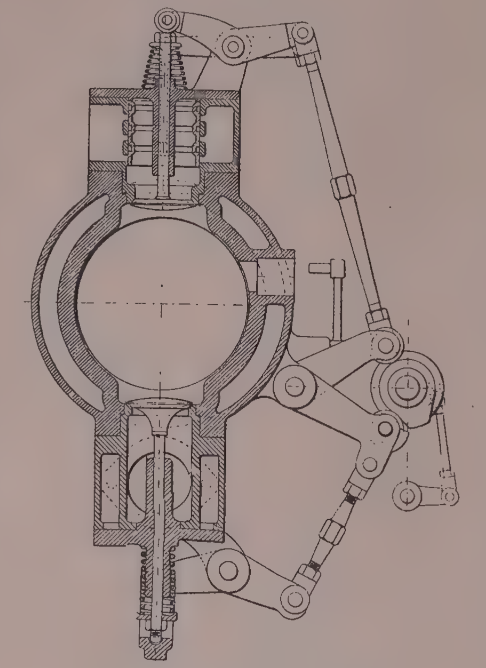
The first series of tests will be made on sand mortars, no facing being used in the manufacture of the block, which will be of a standard size, 9 x 12 x 24 in. Another series will be made, using dry, medium and very wet mixture, using three grades of mortars for each condition, viz.: rich, medium and lean. A series of blocks will be made under the direction of the Committee of the Concrete Block Manufacturers' Association, in accordance with comon practice. It is proposed to build a test oven. Three blocks of each series will be submitted to the test, two with the face towards the inside of the furnace and one with the back of the block facing the inside of the furnace. The blocks are to be laid in lime mortar, and four 3-in. diameter Bunsen burner jets with a fire brick baffle will be used for heating the furnace. It is proposed to raise, at a uniform rate, the temperature of the test oven to a temperature of 1,800° Fahr. during a period of 1½ hours and maintain this temperature for ½ hour. It is then proposed to turn two streams of water of 20 lb. pressure at the nozzle, against the inner walls of the test chamber from points diagonally opposite each other, for a period of five minutes. At the conclusion of the test, wherever possible, it is the intention to make a determination of the strength and other physical properties.

The meeting then adjourned to meet at the call of the chairman. It is hoped that these investigations can be carried to a successful conclusion in order that the subject may be exhaustively investigated. Suggestions will be welcomed as to the best methods of procedure and tests to make; and it is hoped that the work will receive cordial support.

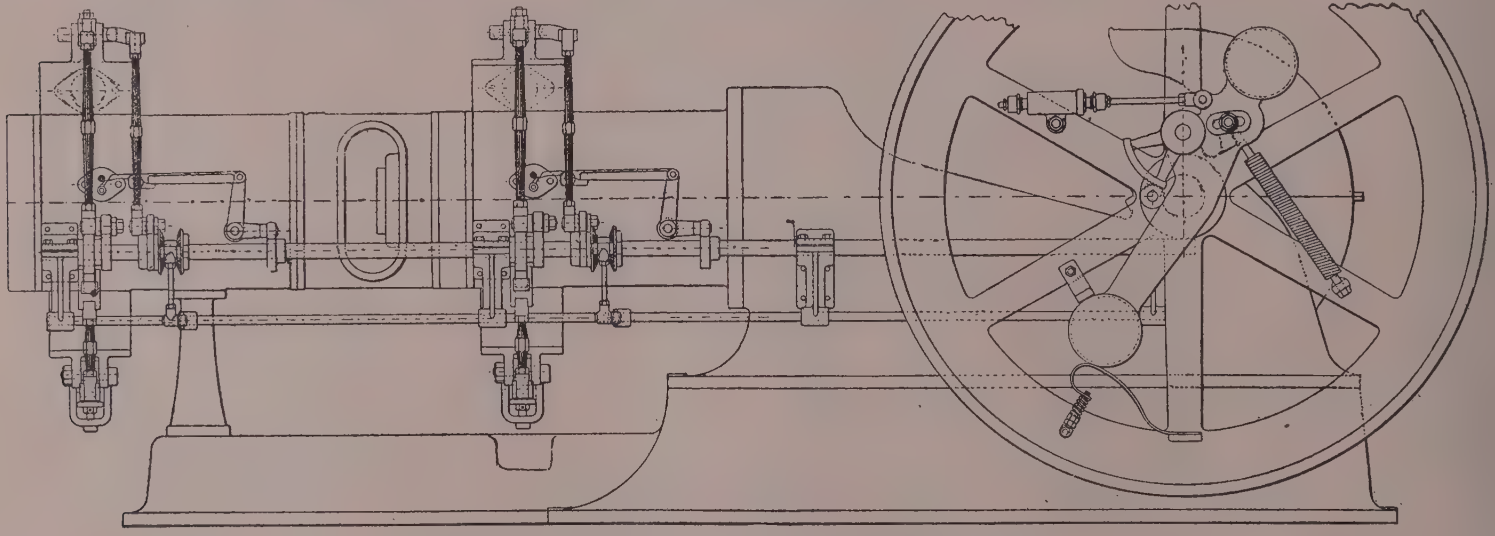
All architects and builders will be glad to know that the new Post Office regulations concerning mail chutes have been printed by the Cutler Manufacturing Co., Rochester, N. Y., with descriptions of apparatus complying with them. The latter have already caused considerable trouble, and cases have arisen where it has been impossible to install chutes in buildings in the places proposed by owners or architects and still have them comply with the rules of the Department.

A NEW AUTOMATIC CUT-OFF GAS ENGINE.

An automatic cut-off gas engine designed to operate on producer gas has recently been put on the market by the J. Thompson & Sons Manufacturing Co., of Beloit, Wis. A 55-h.p. engine is shown in the accompanying illustration. It is of the four-cycle type, with two single-acting tandem cylinders 13 in. in diameter and a 17-in. stroke. The two pistons are of the trunk pattern, attached to the high-carbon steel rod by brass nuts protected from the heat of the gases.



VALVE AND GEAR, THOMPSON ENGINE.



SIDE ELEVATION OF THOMPSON GAS ENGINE, SHOWING GOVERNOR AND VALVE GEAR.

The governor is of the Rites inertia type, specially modified for gas engine service. The cut-off valve is actuated by it through a pair of compensating gears on the cam shaft, which advance or retard the point of cut-off. The cut-off valve is located in the intake valve chest on top of each cylinder, and consists of a bronze cylindrical sleeve working in a bored and ground casing. Wire drawing is avoided by the use of ports of sufficient area to admit a full charge of the explosive mixture. The valves are of the vertical poppet type, of large area, and are so arranged as to do away with pockets and ports to the cylinders. They are actuated by a simple mechanism conveying the motion from the cam shaft in such a manner as to give a direct vertical movement to the valve stems.

The water jackets of each cylinder, each valve chest and the intermediate head, which also forms the piston rod packing chamber, are all independent, thus doing away with water-packed joints and permitting the cooling of each cylinder to be regulated separately.

The electric igniters are of the hammer break type, inserted into the side of each cylinder. The points are just inside the combustion chamber, where the plugs are not exposed to the extreme heat of the gases. The igniters are easily timed while the engine is running, so as to give the best results. The starting apparatus consists of an air-pressure tank and a suitable valve mechanism.

The makers call particular attention to the piston rod packing. This is made in two sets, of Allen metal guaranteed to withstand a temperature of 1,400°. The packing is cut into three segments to the circle, which are fitted into a conical cup and forced into place by a spring. These cups are free to move within the cup chamber, so as to allow for wear and vibration.

The suction producer built for use with this engine has a producer, scrubber and drying tank or equalizer, and is of the Burger type. The makers guarantee that the producer and engine when running full load will furnish 1 h.p.-hour on 1 lb. of anthracite pea coal containing not over 5 per cent. of slate. The engine is guaranteed to regulate within 2 per cent. from no load to full load.

A POWER TRANSMISSION CHALLENGE

In the spring of 1904, the engineer of the Transmission Rope Department of the American Manufacturing Co., read a paper before the New England Cotton Manufacturers' Association, showing the relative cost of rope, belt and electrical drives in cotton mills. This paper brought forth considerable criticism at the time, the most severe coming from partisans of electrical transmission. Our reply to this criticism was the following offer, which was printed in practically all of the technical and trade papers of the United States:

"The American Mfg. Co., of 65 Wall St., New York, will agree to furnish the necessary rope sheaves, rope and driven head-shafts, for the main drive of any cotton mill, using 500 or more h.p. developed at the mill site, at one-quarter the price for which any responsible company furnishing electrical apparatus will agree to install generators, motors, motor shafts, switchboard, wiring and other appliances necessary to electrically transmit the same power. Where the power is generated at a distance from the mill site, if the mill will install one central motor, The American Mfg. Co. will agree to distribute the power from same to the main line shafts, by means of rope drives, for half the cost of electrical apparatus to distribute the same power. This offer is made to any cotton or woolen mill in the United States."

It is sixteen months since this offer was made. So far, no manufacturer of electrical apparatus has come forward to take up the challenge. The company now repeats the offer, with the following addition:

"We will guarantee to any cotton or woolen mill using 500 h.p. or more, a saving of 25 per cent. in fuel consumption in favor of rope drives over any electrical equipment that can be installed, the same engine being used for both transmissions. Further, in case we fail, we will remove our apparatus without expense to the mill owner, and pay a forfeit of $10,000 to cover loss and inconvenience to the company making the trial; provided any concern furnishing electrical appliances will take the other side of the proposition and duplicate this offer."

Some time ago the Terry & Tench Co., Inc., 131st St. and Lexington Ave., New York, decided to manufacture for general sale a number of those specialties for contractors' purposes which they had found of value in their own work. These specialties are numerous enough to require a 74-page book for an account of them. Many of them have been described in this journal and refer to derricks and derrick fittings; others are of general use in handling materials.

BUSINESS NOTES.

The W. E. Speir Co., builders, succeeding W. E. Speir, has moved its offices to 1342 New York Ave., Washington.

Progress in the production of mixed metals has now reached such a stage as to require the attention of expert chemists. The Merchant & Evans Co., successor to Merchant & Co., Inc., owning tin plate and smelting works in Philadelphia, has made a specialty of this chemical work, and takes considerable pride in its well-appointed laboratory. Here the mixtures for solder, linotype, stereotype, electrotype, Babbitt and anti-friction metals are determined and the work checked so as to secure a uniformly high grade. The works, it may be added, have been operated continuously for over 25 years, except for the shut-downs for necessary repairs and similar causes.

A contract for a larry trestle of steel construction has been awarded to Wm. B. Scaife & Sons Co., Pittsburgh, by the Colonial Coke Co.

Henry A. Hitner's Sons, Huntingdon and Aramingo Aves., Philadelphia, were the successful bidders at the recent sale of the locomotives formerly used on the Brooklyn Heights R. R. Enquiries concerning these locomotives may be addressed to the New York office, 32 Broadway, or to Philadelphia.

Among the large heating equipment orders recently taken by the B. F. Sturtevant Co. was one for the blacksmith, erecting and carpenter shops of the Wheeling & Lake Erie R. R., at Canton, which will have nearly 1,250,000 cu. ft. of space; one for the new ordnance shop of the Midvale Steel Co., Nicetown, containing over 5,000,000 cu. ft. of space, and one for a silk mill of Woodhouse, Bopp & Co., Pittsburg, containing over 1,000,000 cu. ft. The company's roundhouse heating system is being installed at the Erie R. R. houses at Salamanca, Port Jervis, Meadville and Cleveland. Sturtevant economizers have recently been ordered by S. D. Warren & Co., Boston; the Oxford Paper Co., Rumford Falls, Me.; the Bourne Mills, Fall River, Mass.; the Hampton Co., Easthampton Mass.; the Syracuse Railroad Construction Co., Auburn, Mass.; the New England Co., Rockville, Conn., and the Solvay Process Co., Syracuse, N. Y.

The Canadian White Co., Ltd., has been awarded the contract for erecting at Hamilton, Ont., the new head office building for the Federal Light Assurance Co. Finley & Spencer, of Montreal, are the architects. This building will be 8 stories high and of steel fireproof construction. The Canadian White Co. has the entire contract, and will have the building ready for occupancy not later than Aug. 1, 1906. The Canadian White Co., Ltd., has also has been warded the contract for the construction of the street car sheds for the Montreal Street Railway Co., Marchand & Haskell, architects.

At a meeting of the directors of the Crocker-Wheeler Co., Ampere, N. J., held on Oct. 13, the regular quarterly dividend of 1½ per cent. was declared.

The Westinghouse Machine Co., East Pittsburg, Pa., has received the following large orders for their Roney mechanical stoker: Jones & Laughlin Steel Co., Pittsburg, Pa., sixteen 114 x 24-in. grate stokers; Lehigh Valley Traction Co., Philadelphia, Pa., eight 130 x 20-in. grate stokers; Pressed Steel Car Co., Pittsburg, Pa., six 100 x 20-in. grate stokers. These stokers are of the inclined grate type with removable fuel plates, provided with the necessary mechanism for automatically controlling the motion of the grate bars and the supply of fuel, and are designed for burning low-grade bituminous coal. Additional smaller orders for Roney stokers have been received from the following parties: Brown Shoe Co., St. Louis, Mo.; The Water, Light & Gas Co., Hutchinson, Kan.; William Wanton Dunnell, Aponaug, R. I.; Pennsylvania State College, State College, Pa.; Pennssylvania Heat & Power Co., Wilkinsburg, Pa.; Merchants Light, Heat & Power Co., Canton, O.; Schlitz Brewing Co., Milwaukee, Wis.; and United Shoe Machinery Co., Beverly, Mass.

The American Blower Co., reports all departments of its Detroit shops in a very busy condition at the present time. Among the large orders now in hand is one for the complete heating equipment for the new Allegheny shops of the Pennsylvania Lines West of Pittsburg. This company has also received orders for the ventilating outfits for the Altman Building in New York and the Marshall Field Building in Chicago. These two orders cover eighteen large fans together with heaters and tempering coils containing an aggregate of about 60,000 ft. of 1-in. pipe.

An order received by the Abner Doble Co., San Francisco, from the California Gas & Electric Corporation calls for six 570-h.-p. wheels for its Nevada City plant. These wheels will operate under a 190-ft. head at 410 r.p.m. A 400-h.-p. wheel for operation under a 400-ft. head, equipped with jet deflector operated by a Woodward compensating governor, has been shipped to the Chancellor Gold Mining Co., Wenatchee, Wash. The LaGrande Water Storage Co., LaGrande, Ore., has purchased an 800-h.-p., 1,150-ft. head, 600 r.p.m. wheel, equipped with Doble needle regulating nozzle for operation by a Lombard governor. Among other recent orders secured by the Doble Co. are two double 1,750 h.-p. wheels for the San Joaquin Power Co., Fresno, Cal., for operation under 385-ft. head; one Doble needle regulating nozzle for a large water wheel for the Komata Reefs Gold Mining Co., New Zealand, and a double 700-h.-p. wheel for Mitsui & Co., Japan, for operation under 210-ft. head, this order including the wheel complete with Lombard governor and gate valve.

Wm. B. Scaife & Sons Co., Pittsburg, Pa., has been awarded the contract for all the structural steel and plate work for a new blast furnace to be built by the Dunbar Furnace Co., Dunbar, Pa.

The Ryder Wire & Mfg. Co., 43 Exchange Place, New York, was recently incorporated with a capital stock of $200,000, for the purpose of manufacturing all kinds of wire and fibrous fabrics; iron, steel and copper wire, rope and insulated wire. The president and treasurer of the company is G. F. Valentine, formerly president and treasurer of the Magnet Wire Co. The company will manufacture fabrics under patents covering products and machines of H. Ryder, its vice-president, who was formerly manager of the Ryder Belt & Cordage Co., Buffalo, N. Y. The wire rope to be produced by this company will be made by a new process which, it is claimed, entirely eliminates torsion and increases the strength and lasting qualities of the rope about 10 per cent. The fabrics and rope which this company will produce will be made of fine wire about which a fiber has been spun, giving a durability and strength especially desirable in the case of air brake coupling hose, fire hose, automobile tires, and other like articles which are subjected to high pressure and hard usage. The new material is said to be particularly valuable as a covering for automobile tires, as it makes them puncture proof and prevents skidding.

The General Electric Co., one of the largest exhibitors at the Lewis & Clark Exposition, announces that it has received the highest award, a gold medal, from the Superior Jury of the Exposition for its exhibit as a whole in the Electrical Department. A gold medal has also been awarded for each of the following features of this exhibit: Curtis steam turbine; meters and instruments; time limit relays and oil switches; switchboards, meter controlling panels, circuit breakers and lightning arresters; direct and alternating motors; direct and alternating current generators; static transformers; automatic voltage regulators; magnetic arc lamp; alternating and direct current enclosed arc lamps; mercury arc lamps; magnetic starting device for mercury arc lamps; mercury arc rectifier; railway motors and controllers; mining locomotives; searchlight and method of control, and the new metalized carbon filament incandescent lamp. Edison incandescent lamps, and the Meridian lamp, furnished by the General Electric Co., have been used for lighting the Exposition.

Mr. Geo. S. Woodruff has opened an office at 1420 Chestnut St., Philadelphia, for buying and selling new and released locomotives, passenger and freight cars, rails, trolley cars, trucks and motors, steam shovels, dump cars and all classes of machinery.

G. M. Gest, the expert subway contractor of New York and Cincinnati, has been awarded a contract for the construction of a complete electrical subway system for the Dayton Lighting Co., Dayton, Ohio. This plant has recently been acquired by new interests, who are rebuilding and re-equipping it throughout. The contract given to Mr. Gest is for subway installation for the whole city, covering 20 miles of streets, and involving over 1,000,000 ft. of conduit. The system is to be of the best type and the amount involved will be in the neighborhood of $250,000.

The Pacific Gas & Electric Co. has filed incorporation papers to take over the San Francisco Gas and Electric Co. and the California Gas & Electric Corporation, provided their stockholders consent. The new company will have $10,000,000 preferred and $20,000,000 common stock.

The Broderick & Bascom Rope Co., St. Louis, has received gold medals from the Lewis and Clark Centennial Exposition for its exhibits of wire ropes, power transmission cables, aerial cables for transporting ore, hawser steel cables for marine use, wire rope for logging, wire rope and aerial cables for mining, tramways and for originality of design and practical demonstration of entire exhibit.

The Sturgess Governor Engineering Co., Watervliet, N. Y., has closed a contract for water-wheel governors and mechanically operated relief valves for the Wares Shoals Mfg. Co.'s plant at Wares Shoals, S. C., and for a 24-in. mechanically operated relief valve for one of the units of the Hudson River Electric Power Co., at Spier Falls, N. Y.

Last July Mr. E. A. Rix read a paper before the Pacific Coast Gas Association on the compression and transmission of illuminating gas. It is probably the most complete discussion of the principles of the flow of gas through pipes and the pressures needed for such flow, that was ever written. It has been reprinted by the Rix Compressed Air & Drill Co., San Francisco, in a 48-page book.

PERSONAL NOTES.

Mr. R. J. Trammell has been appointed city engineer of Greenville, S. C.

Col. Thomas H. Handbury, Corps of Engineers, U. S. A., has been retired.

Mr. Frederick C. Dunlap, first assistant engineer of the Bureau of Filtration, Philadelphia, has tendered his resignation.

The Lawrence Scientific School has established a school of forest engineering under the general direction of Prof. Richard T. Fisher, assistant professor of forestry.

Mr. Frederick B. Rogers, of Ossining, N. Y., has been promoted by the Croton Aqueduct Commission of New York from assistant engineer to division engineer.

The Board of Advisory Engineers of the Isthmian Canal Commission has returned from its inspection of the conditions along the route of the Panama Canal.

Mr. George T. Barnsley, chief engineer of the Wabash Pittsburg Terminal R. R., the Wheeling & Lake Erie R. R., and the West Side Belt Line of Pittsburg, has resigned.

Mr. E. L. Clarke has resigned as resident engineer on the Big Four R. R. at Mt. Carmel, Ill., to become instructor in civil engineering in the Missouri School of Mines and Metallurgy at Rolla, Mo.

Mr. C. T. Dike, formerly in charge of the track elevation work of the Chicago & Northwestern Ry. at Chicago, has been appointed resident engineer at Pierre, S. D., in charge of the company's extension west of that city.

Mr. Robert Hawxhurst, Jr., formerly chief engineer of the Kohala & Hilo Ry, of Hawaii, is at present in the Philippines making a report on the routes of the proposed railways, for parties contemplating bidding for the concessions.

Mr. William Campbell, instructor in metallurgy at the School of Mines, Columbia University, has received the degree of Doctor of Science from the University of Durham, England, in recognition of his research work at Columbia last year.

Mr. Roscoe N. Clark has been promoted to the position of assistant city engineer of Hartford, Conn., vacated by Mr. H. R. Buck. The resignation of the latter to become chief engineer of the Connecticut Boundary Commission was mentioned last week.

Mr. E. R. McNeill, who was in charge of construction of a portion of the Grand Trunk Pacific Ry. for the last two years, died recently in Winnipeg of typhoid fever. He was well known in Montana, where he was in charge of the engineering work of the Great Northern Ry. for some years.

Mr. T. K. Wells has been appointed superintendent of transportation of the Manila Electric Ry. & Lighting Co., which is controlled by J. G. White & Co. Mr. Wells was with the Wabash and Iron Mountain lines for fourteen years and the Syracuse Rapid Transit Co. for eight years.

Mr. Harry H. Hornsby has been appointed sales manager of the Conduit Department of the Sprague Electric Co., succeeding Mr. Alexander Henderson. He was chief inspector of the Department of Electricity of Chicago for a number of years, and resigned that position to become sales engineer of the conduit department of the Sprague Co., his new office being a promotion.

Mr. Elliott Woods, superintendent of the United States Capitol and in charge of the construction of the office buildings for the Senate and House of Representatives, has appointed the following commission to pass upon the merits of the competitive plans recently submitted for a heating and power station for these buildings: Col. Chas. S. Bromwell, Corps of Engineers, U. S. A.; Dr. S. W. Stratton, director of the Bureau of Standards; Prof. S. Homer Woodbridge, Massachusetts Institute of Technology; Mr. C. P. Gliem, chief electrical engineer of the Capitol, and Messrs. Charles B. Titlow and Richard Harding, respectively steam and electrical engineers of the Library of Congress.

Mr. F. A. Delano, the new president of the Wabash R. R., is personally acquainted with both the civil and mechanical engineering work of railroads. He was born in Hong Kong in 1863 and was graduated from Harvard University in 1885. Immediately after leaving college he was engaged on topographical and railway surveys near Boston and in Colorado, and then became an apprentice in the Burlington shops at Aurora. After completing this shop work he became testing engineer at Aurora and afterward was placed in charge of the Bureau of Rail Inspection Tests and Records. In 1889 he became assistant to the second vice-resident of the Burlington Company, and his rise since then is too well known to require mention.

The death of Sir William Shelford, K. C. M. G., deprives the British government of one of its most trusted engineering advisers and the engineering profession of one of its most influential members. He was born in 1834 and was left at an early age to make his own way in the world. He began his work as an apprentice in a small engine shop in Scotland at weekly wages of 75 cents, but civil engineering proved so much more attractive that in a few years he became a pupil of Messrs. Gale, the eminent water works engineers of Glasgow. After two years of service in this office his employers were so impressed by his ability that they advised him to go to London, which he did, where he entered the office of Sir John Fowler, that great training school for British engineers. Here he made the acquaintance of another young employer, who is now the partner of his son and is as cordially respected in America as in Great Britain, Sir Benjamin Baker. For several years he was in charge of harbor improvements, but about 1859 became connected with the first section of the underground Metropolitan Ry., which his employer was then building. From this time forward he was prominently identified with railway engineering, although he also reported on water and sewerage undertakings of considerable magnitude. His railway work took him to many countries, Canada, Italy, Ceylon, the Malay Peninsula, the Argentine Republic, and toward the latter part of his life, many of the smaller British colonies, with which he was closely identified as consulting engineer to the Crown Agents for the Colonies. It is probably correct to say that he was generally regarded as the leading British consulting engineer for railway work.

TRADE PUBLICATIONS.

The Crocker-Wheeler Co., Ampere, N. J., has issued a flyer descriptive of an automatic belt tightener for use with its form L motors. It is intended for application wherever the limited center distances between pulleys requires an increased area of contact between the pulley and belt.

An album of interesting views of bridges, buildings, sewers, sidewalks and heavy foundations in which Universal Portland cement has been used, has been issued by the Cement Department of the Illinois Steel Co., Chicago. The book also contains the specifications of the American Society for Testing Materials and the Corps of Engineers, U. S. A., and some interesting data concerning the company's enormous manufacturing plants. Tables of tests of the cement by well-known engineers are also given.

An interesting album of views of buildings, industrial plants, shops and other structures erected by the Miller-Collins Co., 1133 Broadway, New York, has just appeared. The company makes a specialty of reinforced concrete, structural steel and heavy foundations, and the illustrations show a number of important works of this nature. It also contains an outline of the special methods and facilities of the company.

Two catalogues of blowers have been published by the Buffalo Forge Co., Buffalo, N. Y. No. BB5 describes a great variety of volume blowers and exhausters for belt driving and direct-connection to electric motors and the Cooley rotary engine. Many of the uses of this line are explained and there are the usual tables of sizes and capacities. Catalogue PB5 describes steel pressure blowers with and without adjustable blades, countershafts and engines. They are designed for supplying blast to cupolas, furnaces, forge fires, sand-blast machines and any work where air is to be forced long distances. A distinguishing feature of their construction is a solid peripheral shell to which the side plates are fastened.

The H. W. Johns-Manville Co., 100 William St., New York, has issued a new catalogue of its pipe and boiler insulation materials. For high-pressure steam work it recommends asbestos-sponge felt, asbestos fire-felt, or 85 per cent. magnesia, depending on conditions. For low-pressure and heating work it advises the use of asbestocel coverings on account of their construction, but it is prepared to furnish air cell and wool felt coverings for this class of work. The book describes the many styles in which these materials are made and explains the methods of applying them.

Slide rules and calculating devices are now a necessary part of the equipment of every engineering office, and a folder describing some new types and also the well-known instruments, issued by Kolesch & Co., 138 Fulton St., New York, is of general interest. One of the new rules is the Multiplex, which is much handier for many computations than the usual Mannheim form.

Contractors and manufacturers who have steel plate work to do will be interested in a special catalogue just issued by the Chicago Pneumatic Tool Co., Fisher Bldg., New York, describing the air-cooled Duntley electric drills. These have been designed to give the same class of service as the portable air drills made by the company, but as electricity is available in many places where compressed air is not to be had, it is manifest that the new apparatus has a special field of its own. The company followed air drill practice as closely as possible in designing the electric tool, and has had it under test for two years. The drills are made with one and with three motors, according to the capacity for which they are intended, and are wound for either 110 or 220-volt circuits. The smaller tools can be run from lighting circuits. The catalogue describes them in considerable detail and gives results of tests made with various sizes to determine the current used.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Argenta (Little Rock), Ark.—See "Power Plants, Gas and Electricity."

Palo Alto, Cal.—The Bd. of Trade is reported to have passed resolutions calling on the Bd. of City Trus. to issue $90,000 bonds for improving the water works.

Lompoc, Cal.—We are informed that the Lompoc Water Co. will expend about $10,000 in improvements, including the construction of a dam, but no bids will be asked.

Trinidad, Colo.—We are informed that no engineer has yet been engaged for the proposed improvements and additions to the municipal water system, to cost about $200,000.

Aspen, Colo.—The citizens are reported to have voted Oct. 10 to purchase the plant of the Castle Creek Water Co., owned by E. R. Brown.

Live Oak, Fla.—An election will probably soon be held to vote on issuing $75,000 bonds for water works; $35,000 for a sewerage system; $75,000 for paving and $10,000 for a city hall and market.

Jacksonville, Fla.—The $400,000 recently voted by the citizens will be used as follows: $90,000 for water mains, $210,000 for sewerage and drainage, $55,000 for opening, grading and paving streets and $45,000 for filling and grading land for parks and bulkheading city lines abutting on creeks and waterways. Philip Priolean, City Engr.

Colquitt, Ga.—N. L. Stapleton, Mayor, writes that it was voted Oct. 10 to construct water works. Engineer not yet selected. Bids will not be called for before 1906.

Monticello, Ga.—See "Power Plants, Gas and Electricity."

Kewanee, Ill.—Bids will be received by S. J. Sharp, Chmn. Water Com., until Oct. 24, for furnishing and erecting machinery, water and steam connections and building a brick engine room and concrete reservoir at the pumping station, as advertised in The Engineering Record.

**Libertyville, Ill.*—McNicholas & Cogan, 84 La Salle St., Chicago, have secured the contract for laying 3,050 ft. 8-in. c. i. pipe, 28,650 ft. 6-in. and 612 lin. ft. 4-in. with fire hydrants, valves, etc., for $27,929 (bids opened Oct. 5). Engineer, Jas. Anderson, Jr., Lake Forest.

East Moline, Ill.—Bids will be received until Nov. 11 by Water Wks. Com. (W. H. Ammerman, Pres.) for a system of water works, comprising stand pipe, pumps, engines, about 17,980 ft. c. i. water mains, about 30 hydrants, pumping station and reservoir. The Kimball Engr. Co., of Davenport, Ia., are the engrs.

Chicago, Ill.—Bids will be received until Dec. 1 by the Dept. Pub. Wks. (J. M. Patterson, Comr.) for furnishing and delivering at the water works shop on Ashland Ave., near 22d St., water meters of the disc type of the following sizes and approximate quantities: 100 ⅝-in., 500 ¾-in., 200 1-in., 40 1¼-in., 100 1½-in., 100 2-in., 80 3-in., 20 4-in., and 12 6-in. meters.

Huntington, Ind.—It is stated that bids will be received until Oct. 24 for a receiving well, 100 ft. in diameter and 15 ft. deep, built of concrete. H. H. Wagoner, City Engr.

Marlow, Ind. Ter.—Water bonds to the amount of $20,000 are reported sold.

Ft. Dodge, Ia.—It is reported that bids will be received until Oct. 30 by L. Fessler, City Clk., for sinking and casing a well 15-in. wide for the first 200 ft. and not less than 8 in. wide at the bottom.

Independence, Kan.—Bids will be received by T. N. Sickels, City Clk., until Nov. 15 for furnishing material and installing a mechanical filtration plant, in three units of 500,000 gal. daily capacity each, as advertised in The Engineering Record.

Donaldsonville, La.—It is reported that this city will expend $30,000 for the construction of water works and $5,000 for paving.

Salisbury, Md.—Louis Dalmas, of Philadelphia, Pa., and others, are reported to have purchased the plant of the Salisbury Water Co.

The Treasurer of the Salisbury Water Co. writes that about $20,000 will be expended in improvements, the work to be done under supervision of the superintendent.

Annapolis, Md.—The following are reported to be the bids opened Oct. 11 at the Navy Dept., Washington, D. C., for constructing a reservoir at the Naval Academy: Noel Constr. Co., of Baltimore, $21,000; the Baltimore Ferro-Concrete Co., Baltimore, $25,901, and the Latta & Terry Constr. Co., of Camden, N. J., $39,000.

Baltimore, Md.—The First Branch of Council has reported favorably the ordinance appropriating $40,000 to complete the laying of water mains in the burnt district.

Worcester, Mass.—City Engr. F. A. McClure has submitted to City Council his report in regard to the further development of the water supply. He recommends an increase of storage on Tutnuck Brook to provide for practically all the run-off of its watershed. This would be done by raising the dam of reservoir 1, and making its maximum depth from 30 to 57 ft., and increasing the average storage 1,600,000,000 gals. He also favors the development of the Asnebunmskit system. He says that any attempt to raise the present dam without an equal or greater amount of stored water to draw upon, would be a grave mistake, and one fraught with great hazard. The total cost of this work, as estimated by the city engineer, would be about $614,000.

Fitchburg, Mass.—The Bd. of Aldermen is stated to have voted on Oct. 17 to acquire land and extend the water service of the city to Lake Wachusetts in Westminster, at a cost of $49,900.

Springfield, Mass.—At a meeting of the City Council of Springfield, on Oct. 16, a majority report of the Bd. of Water Comrs. was presented, recommending that the city resort to Little River as a source for a new water supply. A minority report was also presented by Mayor Dickinson, the third member of the board, advocating the immediate construction of a filtration plant at Ludlow, to provide the city with a safe supply of water in the interval which must elapse before a new supply can become available. He further recommends the construction of the Ax Factory reservoir, and that the city take steps to secure legislative permission to take new supply of water from Huntington watershed. Coupled with this report is stated to have been a communication from the Bd. of Health demanding that a filtration plant be constructed immediately.

Westfield, Mass.—The Bd. of Water Comrs. of Westfield, are reported to have voted to take the water of Little River, for an additional water supply.

Lancaster, Mass.—Geo. T. Bailey, Acting Town Clk., writes that the citizens voted Oct. 11 to appropriate $4,500 for extending the water mains.

Pittsfield, Mass.—The $2,500 recently appropriated by the Bd. of Pub. Wks. is to be used for preliminary work in connection with the increase of water supply and to include surveying land on Ashley Brook; also on Sackett Brook, with a view to installing a storage reservoir.

Rochester, Mich.—W. J. Taylor, Village Clk., writes that the following are the bids opened on Oct. 9 for constructing a 2,000,000-gal reservoir. G. H. Miller & Co., Mt. Clements, $5,820, and Heitsch Bros., Pontiac, $11,363.

East Grand Forks, Minn.—See "Power Plants, Gas and Electricity."

Waverly, Minn.—Bids will be received until Oct. 30 by the Village Council (Wm. Quinn, Pres.) for $8,000 waterworks bonds.

Shubuta, Miss.—See "Power Plants, Gas and Electricity."

Biloxi, Miss.—The City Council is reported to have adopted a resolution providing for an issue of $15,000 bonds, to extend the water mains.

Clinton, Miss.—See "Power Plants, Gas and Electricity."

St. Louis, Mo.—Bids will be received until Nov. 7 by Col. F. Von Schrader, Q. M., U. S. A., for the following: Ft. Huachuca, A. T., one 30-h.p. boiler; Ft. Ringold, Tex.; one 40-h.p. boiler; Ft. Wingate, N. M., one 40-h.p. boiler, and 1 compound pump; Ft. Logan, Colo., 1 compound pump, including labor and material to install.

St. Louis, Mo.—The lowest bid opened on Oct. 10 by the Bd. of Pub. Improv. for the construction of two reservoirs at the Chain-of-Rocks is stated to have been submitted by the Heman Constr. Co., Fullerton Bldg., for $473,000.

Billings, Mont.—Bids will be received at the office of the U. S. Reclamation Service, Billings, until Dec. 15, for the construction of main canal, laterals and ditches, involving the excavation of about 640,000 cu. yds. earth, some rock excav. and furnishing material and labor for various structures, requiring about 330 M. ft. lumber, 140 lbs. steel and 1,400 cu. yds. concrete, as advertised in The Engineering Record.

Bassett, Neb.—Specifications are on file at the office of The Engineering Record, 114 Liberty St., New York, N. Y., for the construction of water works, bids for which will be opened on Oct. 30, as advertised in The Engineering Record. W. T. Phillips, Village Clk.

Newark, N. J.—Morris R. Sherrerd, Ch. Engr., and G. Sanzenbacker, Asst. Engr. Dept. of Water, are reported to have decided to take up in the near future the question of increasing the capacity and improving the arrangement of the water mains in the residential streets throughout the city.

Brooklyn, N. Y.—The following are the bids opened on Oct. 11 by John T. Oakley, Comr. of Water Supply, Gas and Electricity for furnishing, delivering and laying a 30-in. water main in Ave. S and in E. 16th St., Brooklyn Boro. (bidders of Brooklyn unless otherwise mentioned): Donlon Contr. Co., $16,815; Jas. P. Graham, $15,597; Abbott Gamble Co., N. Y. City, $17,838; Frank J. Gallagher, $15,517; Thos. O. C. Sloane, $16,811; J. L. Carey, $17,860, and Isaac Harris & Co., $15,860.

The following are the totals of bids opened same time and place for furnishing and delivering stopcocks in Brooklyn Boro.: McMann & Taylor, $12,937; W. Tappen, $12,975; Rensselaer Mfg. Co., $12,000; John Fox & Co., $18,325, and Kennedy Valve Mfg. Co., $12,814.

Bids will be received until Oct. 25 by John T. Oakley, Comr. Water Supply, Gas and Electricity, New York City, for tapping 20-in. and 30-in. water mains in service and hauling and setting 6-in. hydrant service mains, fire hydrants and appurtenances on various streets in Brooklyn Boro.

Bids will be received until Nov. 8 by John T. Oakley, Comr. Water Supply, Gas and Electricity, New York City, for furnishing, delivering, erecting and connecting 4 water tube boilers at the new Ridgewood pumping station.

Schroon Lake, N. Y.—The Schroon Lake Water Supply Co. is reported incorporated with a capital of $15,000 by M. C. Pitkin, C. H. Wilson and J. R. Stanton, all of Schroon Lake.

Ithaca, N. Y.—The Water Bd. is reported to have decided to ask Common Council for permission to issue $75,000 bonds to perfect the artesian water supply.

Watervliet, N. Y.—The question of constructing municipal water works is reported under consideration.

**Items marked thus give the names of parties awarded contracts.*

New York, N. Y.—The following are the bids opened on Oct. 11 by John T. Oakley, Comr. Water Supply, Gas and Electricity, for furnishing, delivering and laying water mains, including stop cocks, hydrants and connections in Fulton, Prospect and Wilton Aves., and other streets in Manhattan Boro.: (*a*) Gallo & Paelli, 127 Mulberry St., (*b*) L. D. Gregory, 125th St. and 1st Ave., (*c*) Cunningham & Kearns, 438 E. 91st St., (*d*) Wilton Construction Co., 115 Elliott Ave., Williamsbridge, (*e*) M. O'Brien, (*f*) T. N. Lewis, 49 W. 27th St., (*g*) John Cornwell, 69 E. 127th St., (*h*) Jos. Burns, 1909 Amsterdam Ave.:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
440 tons straight pipe	$33.00	$29.00	$30.80	$28.00	$31.00	$27.50	$30.00	$29.75
20 tons specials	70.00	65.00	60.00	59.00	60.00	60.00	65.00	62.00
10 cu. yds. rock without blasting	5.00	8.00	10.00	.23½	5.00	10.00	10.00	5.00
700 cu. yds. rock	3.00	2.50	3.00	.23½	2.50	3.50	2.00	2.00
10 cu. yds. masonry excavation	.01	.23	.30	.23½	.01	3.00	1.00	1.00
10,750 cu. yds. earth excavation	.30	.23	.30	.23½	.25	.35	.22	.25
10,800 cu. yds. fill	.30	.23	.30	.23½	.19	.17	.12	.10
900 lin. ft. 12-in. pipe	.30	.26	.35	.35	.25	.36	.40	.30
21,000 lin. ft. 6-in. pipe	.18	.14	.19	.16	.12	.18	.20	.20
15 cu. yds. rubble masonry	.01	.01	10.00	.01	.01	6.50	.01	6.00
5 cu, yds. brick masonry	.01	.01	10.00	.01	.01	15.00	.01	12.00
5 cu. yds. concrete	.01	.01	7.00	.01	.01	7.50	.01	8.00
60 sq. yds. asphalt pavt	2.00	4.00	4.00	4.00	4.00	4.00	.01	4.00
25 sq. yds. granite pavt	1.00	.01	2.00	.01	.60	2.50	.01	2.00
705 sq. ft. pavt	.01	.01	.50	.35	.60	.40	.01	1.00
150 sq. yds. macadam	.01	.01	.50	.01	.10	.01	.01	.50
80 lin. ft. curb	.01	.01	.20	.01	.01	.01	.01	.10
115 ft. 6-in. boxing	6.00	7.00	8.00	5.25	2.50	5.00	6.00	.10
500 ft. lumber	.01	.01	30.00	.01	.01	10.00	.01	30.00
Totals	$38,962	$33,614	$38,830	$32,245	$33,361	$36,169	$34,441	$34,151

**Lyons Falls, N. Y.*—The following are the bids opened on Oct. 12 for the construction of water works, consisting of a reservoir and about 4¾ miles of c. i. mains and appurtenances (Engineers, Knight & Hopkins, Rome, N. Y.): G. H. Eldredge, Ossining, $30,000; Henry Lashnay, Lyons Falls, $23,363; A. F. Nims, Philadelphia, Pa., $29,950; Abbott Gamble Co., N. Y. City, $32,100, and John Marsden, Utica, $24,850 (awarded contract).

Buffalo, N. Y.—The Expert Water Comn, consisting of Col. Thos. W. Symons, Gen. Geo. S. Field and Rudolph Hering, of New York, submitted to the Bd. of Aldermen, on Oct. 9, its report on improving the water supply of Buffalo; it recommends intake, tunnel, shafts, conduits, etc., at a cost of $900,000; Porter Ave. pumping station, $900,000; changes in force mains and valves at present station, $50,000; new large mains, $800,000; high service reservoir, $50,000, and contingences, etc., $100,000; total cost, $2,800,000.

Mechanicsville, N. Y.—C. E. Hicks, Village Engr., writes that about $10,000 to $12,000 will be expended for an additional water supply, the work to include pumping station, the pump to have a capacity of 1,500,000 gal. every 24 hours, and a steel tank 25 x 35 ft. An election on question will be held.

**Lakewood, N. Y.*—Ellery Colby, of Oswego, is reported to have secured the contract for constructing water works (bids opened Oct. 9) for $22,750.

Auburn, N. Y.—The Clerk of the Water Works Comn. is reported to have been authorized to secure bids for extending the intake pipe.

Greensboro, N. C.—J. M. Bandy, Ch. Engr., Water and Light Comn., writes that bids received on Oct. 16 for the reservoir and excavating work in connection with the construction of the water conduit have been rejected. M. H. Kelly, of Asheville, bid for this work $47,000 and Ogburn & Hobbs, of Greensboro, bid $52,943.

*The contract for furnishing pipe for the proposed water conduit (bids opened Oct. 16) has been awarded to the Excelsior Wood Stave Pipe Co., for $58,000.

Carthage, N. C.—D. A. McDonald, Town Comr., writes that it is proposed to construct water works and a sewerage system at a cost of $20,000. No engineer engaged as yet. W. H. McNeill, Mayor.

Fayetteville, N. C.—Water works and sewerage bonds amounting to $100,000 are reported sold.

Valley City, N. D.—It is reported that W. T. Craswell, City Aud., will receive bids until Nov. 6 for constructing about 2,220 ft. 4-in. main on 4th St., and 225 ft. 4-in. main on 5th Ave.

Glouster, O.—This city is reported to have in contemplation improvements to the water works.

Painesville, O.—Dr. W. T. Miller, of Cleveland, a member of State Bd. of Health, in an address to the Lake County Medical Society on the water supply of Painesville, is reported to have advised the establishment of a filtration plant.

Cincinnati, O.—The lowest bid opened on Oct. 13 by the Bd. of Trus. Comrs. of Water Works for laying water mains under Millcreek at Ludlow was submitted by Thos. Maloney, for $9,982.

Bratenahl, Cuyahoga County, O.—Bids will be received until Nov. 16 by Clifford A. Neff, Village Clk., for $5,000 bonds, the proceeds to be used to construct water works and to supply water to the village.

**Toledo, O.*—The following are the grand totals of bids opened on Oct. 10, by the Bd. of Public Service, for the construction of the water purification works, being Contract No. 4 of the improvement of the water supply: J. G. White & Co., New York, N. Y., $557,625 (time 730 days); B. F. Perkins & Son, Holyoke, Mass., $530,468 (600 days); Thos. Lightbody, Youngstown, $425,334 (550 days); Norwood Eng. Co., Florence, Mass., $483,327 (700 days) (awarded contract, subject to approval of State Bd. of Health); J. C. Carland & Co. (Peoples Con. Co.), Davenport, Ia., $554,284; Pittsburg Mfg. Co., Pittsburg, Pa., $524,688 (600 days); A Bentley & Sons, Toledo, $572,727 (800 days); H. P. Burgard, Buffalo, N. Y., submitted a partial bid of $367,565 (time 500 days); H. W. Christian, of Toledo, bid only for electric wiring, $18,490; Shaw-Kendall Engr. Co., Toledo, bid only for steam heating, $7,135. Chas. L. Parmelee, Consulting Engr., 136 Liberty St., New York, N. Y.; Frank I. Consaul, Ch. Engr.; and Edw. D. Bolton, Dept. Engr., Bd. Pub. Service.

Ft. Stevens, Ore.—Bids will be received until Nov. 7 by F. G. Hodgson, Ch. Q. M., Vancouver Barracks, Wash., for erecting a 150,000-gal. steel tank on a 75-ft. trestle at Ft. Stevens.

Junction City, Ore.—The Gilmore Water Power Co. is reported incorporated, with a capital of $5,000, to build ditches, flumes, and pipe lines for irrigation purposes. S. P. Gilmore, of Junction City, is reported interested.

Bristol, Tenn.—The Bristol-Goodson Water Co. is reported to have offered its water works in Bristol to the city, for $150,000.

Eagle Lake, Tex.—The City Council is reported to have granted J. C. Semprez a franchise for water works.

Franklin, Va.—The Village Recorder writes that the citizens voted Oct. 14 to issue $40,000 bonds for water work and a sewerage system.

**Ft. Myer, Va.*—Geo. C. Thomas, 26 Cortlandt St., New York, N. Y., has secured the contract for the steel tank and trestle for the water supply system of Ft. Myer, for $5,613, and R. W. Darby, of Washington, D. C., secured the contract for the intake pipe for $12,700 (bids opened Sept. 15).

**Spokane, Wash.*—The Bd. of Pub. Wks. is reported to have on Oct. 11 awarded to Chas. C. Moore & Co., of Dayton, O., a contract for furnishing all pumps and pumping machinery for the new pumping station, for $19,029; it also awarded the contract for two improved turbine water wheels for the new station to the Dayton Globe Iron Wks., Dayton, O., for $9,800.

Tenino, Wash.—See "Power Plants, Gas and Electricity."

**Seattle Wash.*—The International Contract Co. is stated to have secured the contract for laying machine banded wooden water pipe on N. 76th and other streets, for $9,541.

Olympia, Wash.—An election will probably soon be held to vote on acquiring the Olympia Water Works, by condemnation proceedings.

Harry C. Heerman, Pres. Olympia Water Works Co., writes that it is proposed to construct a flume line up Moxie Creek at a cost of $10,000. No bids will be called for. Work to be done by the company.

Shoshone Agency, Wyo.—The following are reported to be the bids opened on Oct. 3 by the Comr. of Indian Affairs, Washington, D. C., for the construction of a water and sewer system at the Shoshone Indian School: W. H. Dickinson, Shoshone, $20,440; W. D. Lovell, Minneapolis, 6 bids, ranging from $15,243 to $20,975.

SEWERACE AND SEWACE DISPOSAL.

Notes Arranged Alphabetically by States.

Woodlawn, Ala.—At a recent meeting of City Council definite steps are reported to have been taken looking to the immediate construction of a sewerage system. Mr. Perryman, Mayor.

San Francisco, Cal.—The Street Committee has approved the resolution providing for the construction of a sewer along the west end of Union St., at a cost of $55,000.

It is reported that the City Engr. has completed plans for the sewer in Mission St. bet. 2d and East Sts., as far as possible, before the selection of the site for the pumping station.

Washington, D. C.—All bids opened on Sept. 28 by Capt. A. W. Butt, Q. M., U. S. A., for constructing a sewer from the coal testing plant on U. S. Reservation, at south end of Aqueduct Bridge, Roslyn, Va., to the Potomac River, have been rejected, bids submitted being considered excessive.

Live Oak, Fla.—See "Water."

Jacksonville, Fla.—See "Water."

Mattoon, Ill.—Plans are being prepared for an extensive drainage system for the northern part of the city. Claude L. James, City Engr.

**Rockford, Ill.*—Edwin Main, City Engr., writes that the contract for constructing sewers (bids opened Oct. 11) has been awarded to G. Maffioli, of Rockford, and S. Vandewalker, of Belvidere, at a total cost of $5,200.

South Bend, Ind.—Plans will shortly be ready for the extension of a trunk sewer on Kenwood Ave.; about 4,200 ft. 60-in. sewer.

Laporte, Ind.—It is stated that bids are wanted until Oct. 24 for constructing a 10-in. tile sewer in E. Maple Ave. C. E. Wolfe, City Clk.

Des Moines, Ia.—Bids will be received until Nov. 3, by the Bd. Pub. Wks. (W. W. Wise, Chmn.) for constructing about 675 lin. ft. 24-in. vitr. clay pipe sewer in Hayes St.; also about 1,303 lin. ft. 12-in. vitr. clay pipe sewer in York St.

It is stated that bids will be received until Oct. 27 by the Bd. Pub. Wks., for constructing about 1,300 ft. 12-in. vitrified clay pipe sewer in York St.

**Georgetown, Ky.*—John B. Graves, of Georgetown, is reported to have secured the contract for constructing a sewerage system (bids opened Oct. 2) for $25,150.

**Lexington, Ky.*—The Hill-Gaynord Constr. Co., East St., St. Louis, Ill., has secured the contract for constructing the new main sewers (bids opened Sept. 13) for $78,049.

Pipestone, Minn.—Local press reports state that the contractor in charge of constructing the sewerage system at Pipestone has abandoned the contract.

**St. Paul, Minn.*—J. M. Thornton has secured the contract for constructing a sewer on Baker St for $4,395

The following are reported to be the bids opened on Oct. 9 for the construction of sewer on Cretin, Grand, Lincoln, Cleveland and Finn Sts.: Jas. Forrestal Co., $30,700; John Lind, $23,500; Ryan & Johnson, $23,690, and W. J. Prendergast, $24,500.

Eveleth, Minn.—Bids will be received until Oct. 25 by the City Council at the office of Louis Larson, City Clk., for furnishing 1,592 ft. 8-in. sewer main and 4 manholes, to complete said sewer main, from Grant Ave. to Roosevelt Ave. or Jackson St.

St. Louis, Mo.—The Bd. of Pub. Improv. on Oct. 13 approved an ordinance providing for a 925-ft. extension of the Gimlin sewer, in Baden; appropriation $15,000.

Concord, N. H.—The Bd. of Aldermen is stated to have voted to appropriate $5,000 to construct a sewerage system in the Fosterville District.

Plainfield, N. J.—Bids are wanted Nov. 6 for furnishing material and constructing 568 ft. concrete sewer, 2 manholes, 8 branches, 12 inlets and basin connections, as advertised in The Engineering Record.

Jersey City, N. J.—Bids will be received by the Bd. Street and Water Comrs. (Geo. T. Bouton, Clk.) until Oct. 23 for constructing a sewer in a portion of Collard St. Approximate estimate of quantities: 1,130 lin. ft. 30-in. oval brick, 470 lin. ft. 24-in. brick circular, and 1,076 lin. ft. 18-in. vitr. pipe sewers, 900 cu yds. rock excav., 10,000 ft. B. M. sheathing; 10 receiving basins, etc.

Bids will be received until Oct. 23 by the Bd. Street and Water Comrs. (Geo. T. Bouton, Clk.) for constructing a main outlet sewer in Pamrapo Ave. Approximate estimate of quantities: 300 lin. ft. 72-in., 382 lin. ft. 66-in., 338 lin. ft. 63-in. and 580 lin. ft. 57-in steel pipe sewer; 785 lin. ft. 36-in. circular brick sewer; 1,000 cu. yds. rock excav.; 100 cu. yds. concrete; 10,000 ft. B. M. flooring; 50,000 ft. B. M. sheathing; 6 manholes, etc.; bids will also be received same date for constructing a sewer in a portion of Van Winkle Ave. Approximate estimate of quantities: 820 lin. ft. 84-in., 3 rings, 1,555 lin. ft. 60-in. and 667 lin. ft. 48-in. brick circular sewer; 100 lin. ft. 84-in. steel pipe sewer; 1,500 cu. yds. earth excav.; 12,000 lin. ft. piles driven; 28,800 ft. B. M. capping; 45,000 ft. B. M. flooring; 35,000 ft. B. M. sheathing; 10 receiving basins and connections, etc.

The Street and Water Bd. (C. H. Van Kenren, Ch. Engr.) is reported to have passed a resolution calling on the Bd. of Finance, to grant an appropriation of $217,339 to pay for a sewer in the Lafayette Dist. south of Communipaw Ave.

**Newark, N. J.*—Bids opened Oct. 12 by the Bd. Street and Water Comrs. (Edw. S. Rankin, Engr.) for constructing the 1st Division of the Clinton annexation sewers, Section No. 3: Bids were received on both brick and concrete sewers: Totals were figured, and contracts awarded on the lowest alternate prices: (*a*) Harrison Constr. Co., Newark, $36,786; (*b*) Wm. J. McCloud Co., Elizabeth, $35,076 (awarded contract); (*c*) Newark Paving Co., Newark, $36,768; (*d*) Jas. A. Christie, Newark, $39,125:

Brick sewer—	*a*	*b*	*c*	*d*
2,060 ft. 3 ft.	$4.40	$4.35	$5.00	$4.55
640 ft. 3 ft. 6 in.	5.40	5.32	6.00	5.30
425 ft. 3 ft. 6 in. x 5 ft.	9.75	7.50	8.00	9.00
580 ft. 3 ft. 6 in. x 6 ft.	10.95	10.50	12.00	12.25
Pipe Sewers—				
240 ft. 24-in.	2.50	2.60	3.60	2.60
1,850 ft. 20-in.	3.05	2.90	3.53	2.95
1,650 ft. 18-in.	1.75	1.72	1.88	1.68
260 ft. 15-in.	1.45	1.50	1.50	1.45
970 ft. 12-in.	1.05	1.00	1.17	1.00
1,270 ft. 10-in.	.85	.90	1.05	.90
250 ft. 6-in. house connect'n	.75	.75	.90	.70
10 basins with granite heads	115.00	105.00	105.00	105.00
20 basins with concrete	100.00	93.00	90.00	100.00
34 manholes over pipe sewers	50.00	45.00	42.00	50.00
24 manholes over brick sewers	30.00	37.50	32.00	35.00

Alternate Bids:

Monolithic Concrete Sewer—	*a*	**b*	*c*	*d*
2,060 ft. 3 ft.	$4.15	$3.55	....	$4.50
640 ft. 3 ft. 6 in.	5.00	4.25	....	5.25
425 ft. 3 ft. 6 in. x 5 ft.	9.10	6.55	6.90	9.25
580 ft. 3 ft. 6 in. x 6 ft.	10.65	9.70	10.00	12.25
Concrete block sewer—				
2,060 ft. 3 ft.	3.75	3.55	3.50	4.20
640 ft. 3 ft. 6 in.	4.00	3.90	3.85	5.00
425 ft. 3 ft. 6 in. x 5 ft.	7.70	6.75	7.00	8.25
580 ft. 3 ft. 6 in. x 6 ft.	10.30	9.70	10.50	11.50
240 ft. 24-in. concrete	2.05	2.60	2.50	2.55

Brooklyn, N. Y.—Bids will be received until Nov. 1 by Martin W. Littleton, Boro. Pres., for furnishing material and constructing sewer in Bay 23d St., from Bath Ave. to Cropsey Ave. Engineer's estimate 558 lin. ft. 24-in. and 35 lin. ft. 18-in.; 5 manholes; 5,800 ft. B. M. found., etc.; also for constructing 4 sewer basins at 8th Ave. and 60th St.

Cape May City, N. J.—Dewitt D. Barlow, City Engr., writes that the following are the bids opened on Oct. 16 by the City Council, for constructing a portion of the sewerage system: This sewer is to be laid in sand, contiguous to a hydraulic dredge fill, starting 9 ft. below mean low tide, and is to be completed within 6 months. (*a*) J. H. Louchheim & Co., Mint Arcade, Philadelphia, $83,091; (*b*) M. J. Hogan & Co., Real Estate Trust Bldg., Philadelphia, $59,939; (*c*) Robt. E. Hand, Erma, N. J., $78,608; (*d*) B. F. Sweeten & Son, Camden, N. J., $68,041:

	a	*b*	*c*	*d*
5,430 ft. 30-in. c. i. sewer	$13.60	$9.51	$11.92	$10.45
690 ft. 24-in. c. i. sewer	7.20	5.51	10.35	9.20
5 manholes	175.00	172.00	304.50	200.00
12 junction manholes	200.00	224.54	325.50	225.00
50 house connections	20.00	18.87	26.25	25.00

Items marked thus give the names of parties awarded contracts.

***Portland, Ore.*—We are informed that the contract for constructing the Irvington District Sewer (bids opened Sept. 22) has finally been awarded to the Pacific Bridge Co., of Portland, at its lump sum bid of $133,765. Time of completion, 270 days. A rule has been adopted that hereafter all bidding for street and sewer work, unit prices must be given. (D. W. Taylor, City Engr.)

The following are some of the unit prices submitted by the other contractors for the Irvington Dist. Sewer: (*a*) Harry Howard, $138,614; (*b*) Paquet, Giebisch & Joplin, $148,207; (*c*) J. B. Slemmons, $158,199; (*d*) Frieberg Bros., $158,109 (bidders all of Portland):

	a	*b*	*c*	*d*
Brick and stone, circular sewer—				
1,194 lin. ft. 4-ft. 8-in., 2 ring	$6.55	$7.00	$5.20	$5.25
80 lin. ft. 4-ft. 8-in., 3 ring	8.30	8.70	7.64	8.25
1,270 lin. ft. 5-ft. 2-in., 2 ring	7.49	7.50	5.75	5.75
115 lin. ft. 2-ft. 10-in., 2 ring	4.34	5.50	3.85	2.80
Egg shape brick sewer—				
2,193.3 lin. ft. 5-ft. 6-in. x 8-ft. 3-in., 2 ring	7.96	7.26	6.35	7.55
1,835 lin. ft. 5-ft. 4-in. x 8-ft., 2 ring	7.75	7.10	6.10	7.25
1,837.8 lin. ft. 4-ft. 11-in. x 7-ft. 4 1-4-in., 2 ring	7.17	6.52	5.65	6.75
1,896.7 lin. ft. 4-ft. 6-in. x 6-ft. 9-in., 2 ring	6.64	6.18	5.20	6.25
1,888.5 lin. ft. 4-ft. 11-in. x 6-ft. 1½-in., 2 ring	6.07	5.76	4.70	5.75
1,411.5 lin. ft. 3-ft. 8-in. x 5-ft. 6-in., 2 ring	5.50	5.34	4.25	5.25
427 lin. ft. 3-ft. 4-in. x 5-ft. 9-in., 2 ring	5.02	4.94	3.85	4.75
474 lin. ft. 2-ft. 5½-in. x 3-ft. 8¼-in., 2 ring	3.67	4.14	2.90	3.75
Vitrified pipe—				
288 lin. ft. 16-in.	.82	2.00	.82	1.50
74 lin. ft. 12-in.	.65	1.20	.70	2.50
76 lin. ft. 10-in.	.45	1.10	.50	1.00
78 lin. ft. 8-in.	.36	1.00	.50	1.00
640 lin. ft. 6-in.	.24	.50	.25	.50
18 manholes, each	50.00	60.00	100.00	75.00
64,570 cu. yds. excav. and refill	.44	.60	1.00	.80
274 cu. yds. foundation of sewer (crushed rock)	2.50	2.50	3.00	3.00
820 lin. ft. tunneling (7 x 9 ft., 1914 cu. yds.)	7.00	8.00	10.00	10.00

Brooklyn, N. Y.—See "Sewerage and Sewage Disposal."

Ithaca, N. Y.—Williams & Whitman, of N. Y. City, are stated to have prepared and submitted to the Bd. of Sewer Comrs., a report on the question of increasing the efficiency of the Ithaca sewer system. It recommends the construction of a disposal plant at Fall Creek. The sewage could be carried to this plant through a 10-in. pipe and after treatment be discharged into Fall Creek and carried to the lake. Upon this suggestion it was designed to maintain present pumping plant with addition of septic tank. In case new disposal plant is not adopted, it is suggested that an additional outfall to the head of the lake, parallel to the one now used, might answer.

Carthage, N. C.—See "Water."

Fayetteville, N. C.—See "Water."

Lancaster, O.—City Engr. Wolfe estimates the cost of constructing a 3-ft. sewer on 5th St., at $5,900.

Cleveland, O.—Bids will be received until Nov. 1 by the Bd. Pub. Service (W. J. Springborn, Pres.) for extending Miles Park Ave. sewer.

Akron, O.—It is stated that bids will be received until Oct. 25 by the Bd. Pub. Service (Chas. H. Watters, Secy.) for constructing a 4-ft. surface water sewer in Voris, Miami and Thornton Sts.

Akron, O.—Hallinan Bros. are reported to have submitted to the Bd. of Pub. Service the lowest bid for constructing a sanitary sewer to prevent the contamination of Summit Lake, for $31,114.

Barberton, O.—W. F. Robison, Village Clk., writes that it is proposed to construct a brick and concrete sewer on 2d St., to cost about $5,000.

Norwalk, O.—John Laylin, City Engr., writes that sewer plant and disposal works are contemplated. Engineer not yet selected.

Hamilton, O.—It is reported that contracts will probably soon be let for the construction of a system of sanitary sewers.

Carlisle, Pa.—The Special Com. on Sewers is reported to have decided to confer with Engr. Alex. Potter, of New York, N. Y., with regard to a sewerage system, and report to Council next month, when action will be taken as to the advisability of having plans prepared and having the question put to a vote.

Aberdeen, S. D.—Bids will be received until Nov. 10 by the City Council, for furnishing material and constructing an extension of the sewerage system in a portion of Walnut Ave. and 1st St. A. N. Aldrich, Mayor.

***Houston, Tex.*—I. Austin Miller, City Engr., writes that the contract for constructing Preston Ave. tunnel sewer (bids opened Oct. 9) has been awarded to Sargeant & McClintock, of Houston; cost reported to be about $6,500.

Franklin, Va.—See "Water."

North Yakima, Wash.—Bids will be received by J. C. Brooker, City Clk., until Nov. 6 for the construction of a system of pipe sewers, as advertised in The Engineering Record.

Fond du Lac, Wis.—The following are the bids opened on Oct. 7 for the construction of 11,140 ft. pipe sewer, 8 to 27-in. diam. (G. H. Stanchfield, City Engr.): J. Rassmussen, Oshkosh, $14,879; Jas. McCabe, Fond du Lac, $15,368; O'Shea & Shea, Hammond, Ind., $16,134; Chas. Forrestal, Milwaukee, $17,021; J. Kaminski, Berlin, $17,274, and S. H. Coler, Fond du Lac, $19,176.

***Milwaukee, Wis.*—Chas. Forrestal has secured the contract for constructing Sect. 3 of the intercepting sewer for the relief of 30th St. tunnel; he bid $7.50 per lin. ft. for 2,670 lin. ft. 60-in. brick tunnel.

Shoshone Agency, Wyo.—See "Water."

BRIDGES.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—Thos. P. Woodward, City Engr., writes that bids are wanted until Oct. 28 for widening the steel bridge at San Jose and Mt. Vernon Ave.; estimated cost $15,000.

Monte Vista, Colo.—Bids will be received by T. W. Jaycox, State Engr., Denver, until Nov. 6, for constructing a combination bridge, 150-ft. span, across Rio Grande River, near Monte Vista, as advertised in The Engineering Record.

Indianapolis, Ind.—It is stated that bids will be received until Oct. 28 by the Co. Comrs. for constructing a bridge across Eagle Creek, in Pike Township; also for constructing a culvert in Decatur Township.

Auburn, Ind.—It is stated that bids will be received until Nov. 8 by the Co. Comrs. for erecting 11 steel arches and repairing 1 steel bridge. Herman D. Boozer, Co. Aud.

Bloomfield, Ind.—It is reported that bids will be received until Nov. 7 by the Co. Comrs. for constructing an iron bridge with stone abutments, 3 concrete bridges, and a cement or iron bridge, with cement floor.

Holton, Kan.—Bids will be received until Oct. 26 by T. C. McConnell, Co. Clk., for constructing 5 iron county bridges; one to be a 60-ft., one a 70-ft., one a 86-ft., one a 100-ft. and one a 136-ft. span.

Boston, Mass.—Bids will be received until Oct. 26 by Wm. Jackson, City Engr., for the steel draw span of Atlantic Ave. Bridge.

It is stated that bids will be received until Oct. 25 by Jas. Donovan, Supt. of Streets, for widening opening for passage of vessels at Dover St. bridge.

Cleveland, Miss.—It is reported that bids will be received until Nov. 6 by the Clk. of the Bd. at Cleveland, for constructing a bridge across Mound Bayou on the line of Bolivar and Sunflower Counties, and also an same date for constructing a bridge across Labon Bayou. (Rosedale, Miss., is the C. H. of Bolivar County).

Palmyra, Mo.—It is stated that bids will be received until Nov. 7 by H. F. Kizer, Road & Bridge Comr., for constructing an iron bridge in South River Township.

Ulm, Mont.—The Comrs. of Cascade County (Great Falls, C. H.) are reported to be considering the construction of a highway bridge across Missouri River at Ulm.

New York, N. Y.—Bids will be received until Oct. 30 by Geo. E. Best, Comr. of Bridges, for constructing toll houses, spiral staircases and police shelters for the Williamsburg Bridge across East River, between the Boroughs of Manhattan and Brooklyn.

Brooklyn, N. Y.—See "Electric Railways."

Jamestown N. D.—It is stated that bids will be received until Nov. 6 by Andrew Blewett, Co. Aud., for constructing a combination bridge 16 ft. wide and 90 ft. long.

Columbus, O.—It is stated that bids will be received until Nov. 9 by the Co. Comrs. for steel beams, etc., for roadway construction of Green Lawn Ave. bridge; paving roadway of same; reflooring Doddridge St. bridge over Olentangy River, Clinton Township. L. E. Jones, Co. Aud.

Cleveland, O.—Plans of County Surveyor Evers are stated to have been approved for the construction of the Petrie St. Viaduct connecting Cleveland and Newburg Heights Village. The structure will be 595 ft. long and cost $76,000. According to reports bids will soon be received.

Akron, O.—J. A. Gehres, County Surveyor, Akron, writes that the date of opening of bids for constructing the Robinson Ave. bridge in Barberton is Nov. 4 and not Oct. 28, as previously stated.

Vale, Ore.—It is stated that bids will be received until Nov. 8 by the Co. Comrs. for constructing a steel wagon bridge across middle fork of Maheur River at Riverside.

***Greensburg, Pa.*—The contract for constructing a bridge over Four Mile Run, near Darlington, is reported to have been awarded to the American Bridge Co., 100 Bway., New York, N. Y., for $5,137.

Uniontown, Pa.—The following bids are reported to have been opened on Sept. 24 by the Fayette and Westmoreland County Comrs. for constructing a bridge over Jacobs Creek, near Banning Station: Penn Bridge Co., $4,700; Climax Road Machine Co., $6,200, York Bridge Co., $5,966; Eyre Constr. Co., $6,100; King Bridge Co., $4,990, and the American Bridge Co., of New York, $4,930 (awarded contract).

***Bellingham, Wash.*—The County Comrs. are stated to have awarded the contract for constructing a steel bridge over the north fork of the Nooksack River, near Acme, to the Puget Sound Bridge & Dredging Co., of Seattle, for $6,100.

***Toronto, Ont.*—The Hamilton Bridge Co. is reported to have received the contract for constructing 2 bridges over Muskoka River, one at Bracebridge, to cost $14,000 and another at Lake of Bays, to cost $31,000.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Pine Bluff, Ark.—The City Council is stated to have passed an order providing for an appropriation of $12,000 for paving Main St.

Bisbee, Ariz.—Bids will be received until Nov. 7 by C. W. Hicks, City Clk., for constructing about 3,600 sq. yds. vitr. brick pavement on portions of Main St. and Brewery Ave.

Washington, D. C.—The following are reported to be the bids recently received for laying asphalt pavements during the next year: *a* on a contract for 85,000 sq. yds.; *b* on a higher grade paving on a contract for 15,000 sq. yds., price given per sq. yd.: Cranford Paving Co., *a* 98.9 cts., *b* $1.09; Brennan Constr. Co., *a* $1.08, *b* $1.18; Rudolph & Blome Co., *a* $1.03, *b* $1.12; Drew & Sheehan, *a* $1.03, *b* $1.19.

Jacksonville, Fla.—See "Water."

Mattoon, Ill.—Bids will be received about Dec. 1 for the paving of Charleston St. with brick; probable cost $7,056. Claude L. James, City Engr.

***Decatur, Ill.*—A. B. Alexander, City Engr., writes that S. A. Tuttle & Co., have secured the contract for paving Decatur St. and Haworth Ave. with brick, for a total of $11,475.

Indianapolis, Ind.—The following bids are reported to have been opened for paving a portion of Lexington Ave. (price given per sq. yd.): Barber Asphalt Paving Co. (3 bids), $2.88 to $3.17; Marion County Constr. Co., $3.24, and Union Asphalt Constr. Co., $3.14.

Bids for constructing a brick roadway and curbing in Meridian St. are reported to have been received as follows (price given per sq. yd.): Martin Conley, $2.99; A. L. Neisler, $3.08; American Constr. Co., $3.07 for stratified curb, $2.09 for combined curb; Indianapolis Constr. Co., $2.83 for combined curb and $2.93 for stratified curb.

The following bids are reported to have been opened for constructing cement walks and curb in a portion of Greer St. (price given per sq. yd.): A. F. Shorer, $1.41; Indianapolis Constr. Co., $1.40 combined curb, $1.34 cement curb; American Constr. Co., $1.40; Marion Caldwell, $1.46, and Henry Maag, $1.32.

***Indianapolis, Ind.*—The Barber Asphalt Paving Co., 925 E. Vermont St., is reported to have secured the contract for paving a portion of Lexington Ave., a $2 per sq. yd.

Bloomfield, Ind.—It is stated that bids will be received until Nov. 7 by the Co. Comrs. for constructing about 2 miles of gravel roads.

Salem, Ind.—Bids will be received until Nov. 6 by the Bd. Co. Comrs., for constructing the Little York and Brownstown Road in Gibson Township; said road to be 11,057 ft. long and to be built of gravel; estimated cost, $3,388. Frank E. Morris, Co. Aud.

Evansville, Ind.—We are informed that work of paving 6th St. with asphalt has been completed.

***Keokuk, Ia.*—McManus & Tucker, of Keokuk, are stated to have received the contract for macadamizing a portion of Morgan St., for $4,539.

Salina, Kan.—A. W. Godfrey, City Clk., writes that it is proposed to pave 13 blocks in the business part of city with bitulithic pavement. Bids have not yet been called for.

***Atchison, Kan.*—J. H. Fietze, of Atchison, has secured the contract for macadamizing Commercial St. (bids opened Oct. 14) at the following bid: 2,600 cu. yds. grading, 25½ cts.; 5,393 lin. ft. cement curb., 5½x 18-in., 33 cts.; 8,075 sq. yds. macadam, 8-in. deep, 47½ cts.; 2,506 sq. ft. brick sidewalk, 6 cts.; 3,100 sq. ft. brick sidewalks relaid, 3 cts.; 1,462 sq. yds. brick gutters and cross walks, $1.07½; 9 catch basins, ea., $14; 439 lin. ft. 12-in. sewer, 40 cts., and 50 lin. ft. 15-in. sewer, 55 cts.; total, $8,448. The other bids received were O. E. Seip, $10,171; C. Crawford, $9,341; Atchison Paving Brick Co., $8,745.

***Louisville, Ky.*—The Bd. of Pub. Wks. is stated to have awarded contracts for paving as follows (price given per sq. yd.): American Asphalt Co., portions of Dumesnil St. and Bassett Ave. at $1.85; Barber Asphalt Paving Co., 347 5th St., portion of Hemlock St., at $1.85; resurfacing with asphalt a portion of St. Catherine St. at $1.33. The probable cost of these improvements is reported to be about $25,000.

Donaldsonville, La.—See "Water."

New Orleans, La.—See "Miscellaneous."

***Southboro, Mass.*—L. C. Carchia, Tileston St., Boston, has secured the contract for constructing a section of highway at Southboro (bids opened by Massachusetts Highway Comn. Oct. 12) for $4,161.

***St. Paul, Minn.*—Fielding & Shepley, 216 W. University Ave., have secured the contract for improving Winnifried St., for $5,456.

Meridian, Miss.—The Bd. of Supervisors of Lauderdale County are reported to have decided to expend about $100,000 on good roads.

***Kansas City, Mo.*—Contracts for paving are stated to have been awarded by the Public Improv. Com. as follows (price given per sq. yd.): Barber Asphalt Paving Co., New Nelson Bldg., portion Bell St., at $2.12, portion of Kenwood St., at $2.15, and 39th St. at $2.12; Cleveland Trinidad Paving Co., Rose Bldg., portion of 40th St. at $1.92 and Monroe St. at $1.94; Parker Washington Co., 2309 Penn Ave., portion of Cherry St., at $2.15.

Butte, Mont.—The City Council is stated to have adopted the ordinance providing for the extension of Academy St. from Park to Galena, also the widening of Renshaw Alley at a cost of about $40,000.

****Items marked thus give the names of parties awarded contracts.***

Jersey City, N. J.—Bids will be received until Oct. 23 by the Bd. Street and Water Comrs. (Geo. T. Bouton, Clk.) for repaving a portion of Bergen Ave. Approximate estimate of quantities: 11,460 sq. yds. asphalt pavt.; 4,750 lin. ft. resetting in concrete and dressing curb stone; 2,500 cu. yds. earth excav.; 400 lin. ft. curb, 5 x 16 in., set in concrete, etc.

Harrison, N. J.—Bids will be received at the November meeting of the Com. on Streets and Highways, of the Common Council for furnishing material and paving Hamilton St., from John St. to Davis Ave., with telford, requiring about 7,600 sq. yds. telford pavement, 2,200 sq. yds. second hand trap rock furnished by the town, 3,200 lin. ft. new 4 x 20 curb set in concrete, 1,600 lin. ft. old curb reset in concrete, etc. B. P. Walsh, Town Clk.

Buffalo, N. Y.—Bids will be received until Oct. 27 by the Dept. Pub. Wks. (Francis G. Ward, Comr.) for paving portions of Montgomery Ave. and James St.

The following are reported to be the lowest bids opened on Sept. 29th by Francis G. Ward for paving portions of *a* Oneida St., *b* Clare St. and *c* Bond St.: Frank V. E. Bardol, *a*, with brick on macadam base, $16,900; German Rock Asphalt Cement Co., *a* with asphalt on concrete base, $11,424; Louis Gipp, *b* with brick on macadam base, $10,817; Barber Asphalt Paving Co., *b* with asphalt on concrete base, $8,754; Frank V. E. Bardol, *c* with brick on macadam base, $2,100; Barber Asphalt Co., *c* with asphalt on concrete base, $1,509.

Norwood, O.—Bids will be received until Nov. 4 by the Bd. Pub. Service (J. E. Thorpe, Clk.) for furnishing material, grading, curbing, macadamizing and graveling, portions of Norwood and Section Aves. J. A. Stewart, City Engr., Rm. 813, Traction Bldg., Cincinnati.

**Columbus, O.*—Chas. H. Frank, Secy. Bd. Pub. Service, writes that A. G. Pugh, of Columbus, has secured the contract for paving Space St. with asphalt, and Geigle & Gaines, of Columbus, the contract for paving Spruce St. with brick (bids opened Oct. 5).

Cincinnati, O.—Bids will be received until Nov. 6 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for improving a portion of Celestial St., by grading, curbing and paving with bitulithic.

Bids will be received until Oct. 26 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing material and improving a portion of Cohoon St., by grading, curbing and paving with brick; also Nov. 9 a portion of Cinnamon St.

Columbus, O.—See "Bridges."

**Toledo, O.*—The Barber Asphalt Paving Co. is reported to have received the contract for paving with asphalt a portion of 19th St., at a cost of $7,844.

Greensburg, Pa.—Bids will be received until Nov. 6 by the Town Council for grading, curbing and paving with vitrified brick on a portion of Tremont Ave. Edw. A. Cramer, Boro. Clk.

**Chester, Pa.*—The contract for macadamizing the island road from Essington to Bow Creek is reported to have been awarded to Jas. P. McNichol, of Philadelphia, at $16,450.

Reading, Pa.—The only bid received for repairing asphalt streets throughout the city is reported to have been submitted by the Toledo Constr. Co., of Toledo, O., at $1.24 per sq. yd.

**York, Pa.*—The Barber Asphalt Paving Co. is stated to have secured the contract for paving on a portion of S. Beaver St. at $1.54½ per sq. yd.

It is stated that the contract will soon be let for paving with vitrified brick or asphalt Clark Alley, between Market and Beaver Sts.

Nashville, Tenn.—Paving bonds amounting to $125,000 are reported sold.

**Everett, Wash.*—The contract for paving with creosoted blocks on Hewitt Ave. from Grand Ave. to Broadway is reported to have been awarded to Geo. McKenzie, for $51,500.

**Seattle, Wash.*—The contract for grading and laying concrete walks on E. Fir St. was relet on Oct. 7 to Frank & Brandon, of Seattle, for $17,932. He bid $1 per sq. yd. for 7,145 sq. yds. concrete walks and 20 cts. per cu. yd. for earthwork. The other bids received for this work on Oct. 7 were D. Dow & Co., $18,398, and McKennon, $18,526.

*S. Normile has secured the contract for grading Louisa and other streets for $30,225

Resolutions have been passed providing for the paving of Prefontaine Pl. and other streets with sandstone block on certain portions, and vitrified brick on other portions, at a total cost of $105,000; also for grading 3d and other streets at a cost of $13,900; Eastland Ave. and other streets at a cost of $27,800, and for the paving of 15th Ave. N. and other streets at a cost of $30,500.

Moundsville, W. Va.—It is stated that bids will be received until Nov. 6 by Walter A. McGlumphy, City Clk., for paving with vitrified brick on portions of Baker and Thompson Aves.

**Parkersburg, W. Va.*—The Camden Clay Co. is reported to have received the contract for paving a portion of 19th St., at $5,662.

POWER PLANTS. GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Argenta (Little Rock), Ark.—The Bd. of Improvement, W. E. Pearsall, Chmn., and C. J. Humphreys, Secy., are reported to have under consideration plans for the proposed water works and electric light plant; probable cost $85,000.

Hot Springs, Ark.—It is reported that the Citizens' Electric Light Co. is about to be incorporated with a capital of $200,000.

Van Buren, Ark.—The Van Buren Electric Light & Power Co. has been incorporated to construct and operate an electric light plant; capital, $25,000. John E. Powers, Pres.; Henry L. Fitzhugh, Vice-Pres., and Sidney A. Pernot, Secy. and Treas.

San Francisco, Cal.—As a preliminary to the consolidation of the San Francisco Gas & Electric Co. and the California Gas & Electric Corporation, articles of incorporation were filed Oct. 10, of the Pacific Gas & Electric Co.

Washington, D. C.—Bids will be received until Nov. 21 at the Bureau Supplies and Accounts, Navy Dept., Washington, to furnish at the Navy Yards, Mare Island, Cal., and Puget Sound, Wash., a quantity of Naval Supplies, as follows: Motors; electrical fittings; steel rolling shutters; drum hoisting engine; die sinking and surface grinding machine, etc. H. T. B. Harris, Paymaster Gen., U. S. N.

It is reported that plans and specifications have been prepared for the construction of a central heating, lighting and power plant for all the buildings at the Soldiers' Home. Capt. John S. Sewell, Corps Engrs., U. S. A., is Supt. of Construction.

Elliott Woods, Supt. U. S. Capitol Bldgs. and Grounds, is reported to have appointed a commission, consisting of Col. Chas. S. Bromwell, Corps Engrs., U. S. A., in charge of Bldgs. and Grounds; Dr. S. W. Stratton, Dir. Bureau of Standards; Prof. S. H. Woodbridge of the Massachusetts Institute of Technology; C. P. Gleim, Chief Electrical Engr. for the U. S. Capitol; and Chas. B. Titlow and Richard Harding, Steam and Electric Engr., Library of Congress; this commission will select plans and award the contract for the heating, lighting and power plant for the Capitol and other buildings; bids for which were opened on Sept. 30.

Fernandina, Fla.—Arthur R. Low, Vice-Pres. Consolidated Ry. & Light Co., of Philadelphia, Pa., is reported to have submitted to this city a proposition to install a $60,000 gas plant.

Jacksonville, Fla.—The following are reported to be the bids opened on Oct. 4 by the Bd. of Bond Trus. for furnishing two 500-k.w. steam turbine generators, with necessary equipment, for the extension of the city lighting plant: General Electric Co., Schenectady, N. Y., $38,963; Providence Eng. Wks., Providence, R. I., $40,945; Allis Chalmers Co., of Milwaukee, Wis., $36,135; Westinghouse Machinery Co., Pittsburg, Pa., $36,767 for bid "A" and $35,367 for bid "B"; Warren Electric Mfg. Co., Sandusky, O., $31,925; two bids, single flow and double flow, same for each.

Rome, Ga.—R. L. West, of Atlanta, it is reported, is one of the promoters of a company which proposes constructing an electric plant on Etowah River, between Rome and Cartersville to furnish electricity to run machinery and for other purposes. Capital, $400,000.

Monticello, Ga.—Bids will be received until Nov. 7 by W. J. Phillips, Town Secy. and Treas., for $30,000 water and light bonds.

Lockport, Ill.—The Trus. of the Sanitary Dist. of Chicago opened bids Oct. 11 for furnishing electrical apparatus and materials for the power house near Lockport, and for the transmission line along the right of way of the Sanitary Dist. of Chicago. The Western Electric Co., 259 S. Clinton St., it is stated, submitted the only bid on the entire work at $300,000.

**Freeburg, Ill.*—Chas. Kessler, Village Clk., writes that the contract for constructing a municipal electric light plant (bids opened Oct. 11) has been awarded to W. A. Fuller, of St. Louis, Mo., for $8,014.

Breese, Ill.—Wm. H. Bryan, Consulting Engr., Lincoln Trust Bldg., St. Louis, Mo., writes that all bids opened on Oct. 9 by the Breese Water & Light Co., for a new lighting plant, have been rejected and new bids will be received Oct. 30. Victor J. Klutho, Archt., 202 N. 9th St., St. Louis, Mo. Further information can be received by addressing the engineer or the architect.

Chicago, Ill.—It is stated that bids will be received until Oct. 25 by the South Park Comrs. for furnishing and erecting machinery at the power house in Washington Park, as follows: A cross compound condesing engine for direct connecting to a 1,000-kw. generator, 1 cross compound condensing engine for direct connecting to a 500-kw. generator; a 1,000 K. V. A., 3-phase, 60-cycle A. C. generator, two 350-h.p. water tube boilers, automatic stoker and superheaters, a 1,000 K. V. A., 3-phase, 60-cycle turbo-alternators, 500 K. V. A., 3-phase, 60-cycle turbo-alternators. E. G. Shumway, Supt.

Pana, Ill.—The City Council is reported to have granted the Pana Gas & Electric Co., a franchise to lay pipe through the streets and to operate a gas plant.

Valparaiso, Ind.—D. S. Davis, Mgr. Valparaiso Lighting Co., writes that about $30,000 will be expended in improvements, but the company is doing its own work. The improvements include the changing of the electric plant to 3 phase, 60 cycle, one 150-kw. and one 140-kw.; also the laying of new gas mains.

Indian Territory.—The engineering office of W. K. Palmer, 718 Dwight Bldg., Kansas City, Mo., has charge of the engineering work connected with the extensive water power development proposition of the Standard Power & Construction Co., on the north fork of Canadian River, Indian Ter. Complete surveys have been made by the engineer and estimates, report, etc. It is proposed to utilize the exceptionally favorable power conditions of this stream and to transmit power electrically to points in the Territory within a radius of 100 miles. A system of interurban railways is also projected in connection with the enterprise.

Paola, Kan.—The citizens are reported to have voted to issue $25,000 bonds, for the construction of an electric light plant.

Cadillac, Mich.—The Cadillac Water & Light Co. is stated to have been purchased by Grand Rapids and Cadillac capitalists, and reorganized with a capital of $200,000 and an authorized bond issue of $120,000. Wm. H. Anderson, Pres. and Treas., Grand Rapids; Geo. Westover, Mgr., Cadillac.

East Grand Forks, Minn.—The Dwyer Plumbing & Htg. Co., of St. Paul, bid on Oct. 6 for constructing water works and an electric light plant complete, $76,345, and Crawley Co., of Duluth, $78,664. For water works only, T. G. Robertson, of St. Paul, bid $42,550; W. D. Lovell, Minneapolis, $44,000; Dwyer Plumbing & Htg. Co., St. Paul, $47,300; Des Moines Bridge & Iron Co., Des Moines, Ia., $49,600; Pastoret & Lunz, Two Harbors, $48,430.

The following are the lowest bids on other portions of the work: For a triplex power pump (500 gals.) with 60-h.p. motor, Gillmore Rollins, of Minneapolis, $2,760; for two 72-in. x 18-ft. boilers, William Bros. Boiler Wks., Minneapolis, $4,890 and for a 100-ft. high steel tower, with 100,000-gal. steel tank, Des Moines Bridge & Iron Co., Des Moines, Ia., $5,980. Engineer, F. W. Cappelen, Minneapolis.

Minnesota City, Minn.—The Minnesota Light & Power Co. is reported to be contemplating the enlarging of its plant.

**Duluth, Minn.*—J. W. Hillard, it is stated, has secured the contract to construct the distributing station of the Great Northern Power Co. at Fifteenth Ave. and Michigan and Superior Sts., at a cost of about $100,000.

Annandale, Minn.—The Council, it is stated, is considering the construction of a lighting plant.

Clinton, Miss.—A resolution has been adopted by the Mayor and Bd. of Aldermen, authorizing the issue of $2,000 bonds for the purpose of extending the electric light and water works systems.

Shubuta, Miss.—The Shubuta Light & Water Co. is reported incorporated, with a capital of $5,000 by B. Hutchins, A. Bond and others.

**Helena, Mont.*—The Wisconsin Bridge & Iron Co., of Milwaukee, Wis., it is stated, has secured the contract to construct a steel dam near Helena, for the Missouri River Power Co. The dam will be 630 ft. long, 70 ft. high and capable of developing 10,000 h. p.

York, Neb.—There is reported to be a movement here among the citizens, looking to the construction of a municipal electric light plant.

New Brunswick, N. J.—The subject of a municipal electric light plant is reported to be under discussion here by the citizens.

Orange, N. J.—Saml. C. Trimble, Pres. Orange Ice, Light & Water Co., writes that no new construction work is contemplated by this company.

Seabright, N. J.—It is stated that bids will be received until Oct. 25 for furnishing lights to this borough for 1 year from Nov. 5.

New York, N. Y.—Bids will be received until Oct. 24 by the Dept. Correction (Francis J. Lantry, Comr.) for furnishing material and installing new switchboard and remodeling the electric light plant in the power house on Hart's Island, Boro. Manhattan.

Goshen, N. Y.—The Goshen Illuminating Co. is reported incorporated with a capital of $25,000 by Jas. Gamble and Wm. H. Dixon, of New York, and John B. Johnston, of Brooklyn.

**Geneva, N. Y.*—C. T. Church, City Engr., writes that the contract for constructing about 4 miles of electric conduits (bids opened Oct. 5) has been awarded to Thos. Fitzgerald, Jr., of Newark, N. Y., for $26,500.

Syracuse, N. Y.—It is stated that bids received Oct. 9 for lighting the streets and public buildings have been rejected, as prices submitted were considered too high.

Lenoir, N. C.—This town has granted a 30-yr. exclusive franchise to E. C. Ivey and associates for an electric lighting and power plant. The company will at once begin the installation of a 60-k.w. single-phase lighting system, 60 cycles, 2,200 volts. The town has contracted for 21 arc lamps for 5 yrs.

Rochester, N. Y.—W. Gillette, Clk. Bd. Superv., writes that the Purchasing Agent has been directed to procure estimates of cost of an electric light plant for the court house. The work has not yet been authorized.

Mooresville, N. C.—The citizens voted Oct. 10 to construct a municipal electric light plant.

**Fayetteville, N. C.*—The Allis-Chalmers Co., of Milwaukee, Wis., is stated to have secured the contract for overhauling and enlarging the municipal electric light plant for $7,250. The Westinghouse Electric Co., of Pittsburg, Pa., secured the contract for a 235-kw. generator and 60 alternating arc lamps for $5,407 (bids opened Oct. 10).

Danville, Pa.—Bids will be received by Dr. Levi I. Shoemaker, Chmn. Bldg. Com. Bd. of Trus. State Hospital for Insane, until Oct. 27, for the erection of power house, electric generator plant, engines, boilers, motors, etc., and wiring Administration Building, wards, and other buildings, grounds, etc., as advertised in The Engineering Record.

Birdsboro, Pa.—It is reported that plans are being prepared for the construction of a municipal electric light plant.

Plains, Pa.—J. Robertson Williams is reported interested in the construction of an electric light plant.

York, Pa.—It is reported that the Conewingo Electric Power Co. is about to construct a plant to furnish light to York, capable of supplying 30,000 h. p.

Union, Ore.—The Grand Ronde Electric Co. is reported to have prepared plans for a brick substation to be erected in Union; and will expend about $20,000 in bringing current from Cove to Union.

Portland, Ore.—The Portland General Electric Co. is reported to have under consideration the installation of a new plant, to cost about $100,000.

**Chattanooga, Tenn.*—We are informed that W. J. Oliver & Co., of Knoxville, Tenn., have secured the contract for the concrete work of the lock and dam power plant to be constructed at Hales Bar in Tennessee River by the Chattanooga-Tennessee River Power Co., contract price about $1,000,000.

Additional contracts will be let in the near future for other work in connection with the above plant to include hydraulic and electric installation, structural work of power houses, transformers and transmission line. John Bogart, Consulting Engr., 16 Exchange Pl., New York, N. Y.; C. E. James, Pres., Chattanooga.

Richfield, Utah.—The Richfield Light & Power Co., it is reported, intends extending a line to Glenwood, and furnishing that town with light.

**Ft. Myer, Va.*—Malcolm W. Hill Co., of Washington, D. C., has secured the contract for constructing an addition to the electric light system at the Signal Corps Post, Ft. Myer (bids opened Sept. 18) for $2,694.

Burlington, Vt.—The Bd. of Aldermen is stated to have passed a resolution, appropriating $5,000 for the extension of the municipal electric light plant.

Wenatchee, Wash.—The Council, it is reported, is considering the question of purchasing the electric light plant of the Wenatchee Electric Power Co. for $80,000.

Tenino, Wash.—S. W. Fenton, it is reported, has applied to the Co. Comrs. at Olympia, for an electric light and water franchise for Tenino.

**Sharon, Wis.*—The Village Trus. are reported to have awarded the contract for installing a municipal gas plant

Items marked thus give the names of parties awarded contracts.

to furnish gas for fuel and light to the National Light & Fuel Co., of Janesville, for $5,936.

Menasha, Wis.—It is reported that the city is considering the installing of a municipal gas plant.

*_Hartland, Wis._—The Gasoline Gas Light Co., of Des Moines, Ia., it is stated, has secured the contract to install the lighting plant at $5,836.

*_Kimball, Wis._—The Superior Constr. Co., of Houghton, Mich., is stated to have secured the contract to install an electric lighting plant for Kimball, Clark & Co., at Kimball, including the wiring of the company's houses.

Westfield, Wis.—Articles of incorporation have been filed by the Westfield Milling & Electric Light Co. with a capital of $30,000. Incorporators: W. H. Moss, Westfield; Clark Older, Portage, and others.

Fond du Lac, Wis.—The Independent Heat, Light & Power Co. is stated to have petitioned for a franchise in this city.

Milwaukee, Wis.—The Finance Com. of Common Council has decided to recommend for passage a resolution instructing the Bd. Pub. Wks. to receive bids for a site for a municipal lighting plant. The committee has also favorably considered the resolution to employ an expert engineer to draft plans for the proposed plant.

Laramie, Wyo.—The new electric light company, represented by W. C. Stern, of Littleton, Colo., it is stated, has purchased the plant of the old company, and intends making improvements, including the installation of an alternating system.

Chatham, N. B.—P. J. McIntyre, Town Clk., writes that bids will probably be called for about May or June, 1906, for the construction of a municipal lighting plant; probable cost $35,000.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—The Birmingham Ry., Light & Power Co. is stated to have in contemplation the construction of a car line to the town of Jonesboro, 5 miles beyond Bessemer.

Birmingham, Ala.—J. M. Dewberry and associates of Birmingham, are stated to have been granted a franchise by the Tuscaloosa City Council to operate an electric railway in Tuscaloosa county. Similar franchises are reported to have been accorded in Jefferson County. The company proposes to operate an electric railway for conveying freight from the Birmingham district to the Warrior River.

Eldorado, Ark.—C. W. Niehauss, of Wesson, Ark., Secy. and Supt. Eldorado & Wesson R. R. Co., writes that it is proposed to construct a railroad between Eldorado and Wesson. Directors: C. V. Edgar and A. B. Banks, of Fordyce, and C. H. Newell, of Wesson.

San Francisco, Cal.—The Mayor is stated to have signed the ordinance granting a franchise to the Ocean Shore Ry. Co. for constructing the road from the county line to the terminal and Illinois and Army Sts.; also a franchise for the crosstown branch through Golden Gate Park to the Richmond Dist. C. E. Loss is stated to have commenced work on the main line of the railroad between Santa Cruz and San Francisco. Bids have been received for electrical equipment for the power house near Halfmoon Bay, and the award is expected soon. Work on the Islais Creek section of the new line will begin at once.

It is reported that plans are under consideration for an extension of the Petaluma & Santa Rosa Ry. south to Point San Pedro.

The East Shore & Suburban Ry. (W. S. Rheem, Supt.) is reported to have in contemplation the construction of an extension from Point Richmond to Point San Pablo.

Chico, Cal.—It is stated that bids will be received by the City Council, Nov. 1, for a franchise to construct and operate a street railroad for a term of 50 years along certain streets of Chico, as applied for by David S. Edwards, C. E. Steinogul, City Clk.

Napa, Cal.—The Napa & Lakeport R. R., recently incorporated by E. C. Amadee, F. W. Auswell and A. S. Brown, of Oakland, is securing depot sites and terminal grouds along its proposed electric road from Napa to Lakeport. It is said that $2,000,000 is available for its construction. On leaving Napa, the line as surveyed goes through Cutt's Canyon, Chile's and Pope Valleys, passing ½ mile east of Middletown and to Lakeport.

Dover, Del.—The rights, privileges and appurtenances belonging or granted to the Delaware Electric Traction Co., incorporated here some years ago with the intention of constructing a electric railway from Smyrna to Milford, were turned over to new directors, who will within a few days secure a new certificate of incorporation under the name of the Smyrna, Kent County & Delaware Bay Traction Co. U. Gluck, Pres.; Dr. Thos. C. Moore, Secy.; Alfred Tilghman, Treas. As soon as the preliminaries are completed a certificate of incorporation will be filed with the Secretary of State, which will give the new company power to begin the construction of the road. The rights of way already have been secured through the towns of Clayton and Symrna, with privileges to extend the line to Woodland Beach. As soon as the 9 miles of road from Clayton to Woodland Beach is completed the extension will be made on down the line to Dover and thence to Milford, as the Kent County Levy Court has granted the new company the rights of way over the county roads.

Washington, D. C.—A. H. Semms, of Washington, D. C., and others are reported to be considering constructing an electric railway through the city and northeastern suburbs. The line will be about 12 miles long.

Louisville, Ga.—The citizens are reported to have subscribed $25,000 to build a railroad from Wadley to Louisville. It will be an extension of the Stillmore Air Line (G. M. Brinson, Pres. Stillmore, Ga.) and will run from Louisville to the Georgia R. R.

Rexbury, Idaho.—The Yellowstone Park Ry. Co., it is stated, will file articles of incorporation for $125,000 for the purpose of continuing the present St. Anthony branch line through to the National Park borders east of Henry's Lake and over the Montana line. The company will build two roads, one going in a northeasterly direction on to park and another which will leave the main line a few miles northwest of St. Anthony, passing through the town of Marysville, and on in a southeasterly direction into Teton Valley, terminating at Victor. The Yellowstone Park line will be 75 miles in length and the Teton Valley branch will be 50 miles. The contract for the road has already been practically awarded to the Utah Constr. Co.

Brookville, Ind.—The Richmond, Brookville & Cincinnati Traction Co. is stated to have secured nearly all of the right of way through Franklin County, and is now asking for a franchise in Brookville.

Jeffersonville, Ind.—The Louisville & Indianapolis Traction Co. is reported to be surveying a route for an interurban line from Jeffersonville to Columbus via Seymour. A. L. Barker, of Chicago, Ill.; Maurice Cahill, of Indianapolis, and John R. Schundell, of Cincinnati, are reported to be promoting the enterprise.

*_Seymour, Ind._—It is stated that a contract has been placed with E. S. Russell, of Chicago, to build an interurban electric railway from Columbus to French Lick by way of Seymour. The company will be incorporated with $1,000,000 capital. It is stated that the company has merged with the Columbus Street Railway & Light Company, and will use the Company's plant to furnish power for the new road.

Indianapolis, Ind.—It is stated that the Indianapolis, Crawfordsville & Western Traction Co. is preparing plans and specifications for an electric railway. It is estimated the road will cost $2,000,000 when completed and equipped from Indianapolis to Danville, Ill., a distance of 88 miles.

It is stated that the "Electric Cycle Line" is the name of an electric railway being promoted by J. N. Crabb and others to encircle Indianapolis at a radius of about 25 miles. A company is being formed to build the road, it is announced.

Des Moines, Ia.—The preliminary survey of the route for the interurban railway which the Central Ry. Co. of Iowa propose to construct between Des Moines and Ames, is reported to have been completed. The route surveyed is about 45 miles long from the point where connection is made with the Des Moines St. Ry. Co.'s line in Des Moines to Nevada. Thos. J. Wilcox, Pres.

*_Medford, Mass._—Woodbury & Leighton Co., 166 Devonshire St., Boston, is stated to have secured the contract for constructing a power house at Medford, for the Boston Elevated St. Ry. Co., of Boston, for $30,000.

*_South Framingham, Mass._—W. H. Grose & Co., 54 Kilby St., Boston, is stated to have secured the contract for constructing an electric road in South Framingham for the South Middlesex St. Ry. Co.; cost $8,000.

Sault Ste. Marie, Mich.—The Sault Ste. Marie & Les Chenaux Interurban Ry. Co. is reported organized for the purpose of building an electric railway from Sault Ste. Marie to Cedarville via McCarron, McKees, Donaldson and Pickford, a distance of about 35 miles. While the company has not been incorporated, a great deal of the preliminary work has been done and the entire right of way has been secured, including the necessary franchises from the cities and towns along the line. Those interested are now investigating the idea of propelling the cars by means of gasoline motors. Chas. H. Chapman is reported interested.

Sedalia, Mo.—The engineer office of W. K. Palmer, 718 Dwight Bldg., Kansas City, has the contract for the engineering work connected with the Central Ry. of Missouri, which is to be built from Miami to Marshall and Sedalia, approximately 50 miles. A completely equipped field party from the office of the engineer is now engaged in making the surveys and locating the lines.

Jersey City, N. J.—The Hudson Street R. R. Co. filed articles of incorporation on Oct. 16 in the County Clerk's office at Jersey City; capital $3,000,000. It is organized for the purpose of increasing and improving the local transporation facilities throughout the principal cities and towns of Hudson County, with a view to operating these lines in connection with the tunnels now being built under Hudson River. The new lines are so planned as to tap the tunnels at points back from the water front, so that fast time can be made through the congested business districts in Jersey City and Hoboken. Wm. McAdoo, Pres.; K. B. Conger, Secy.

The maps filed by the above company on Oct. 17 show that the company intends constructing 50 miles of trolley connections as a feeder to the tunnel now under construction under Hudson River to the foot of Morton St., New York City.

Brooklyn, N. Y.—Bids will be opened on Nov. 2 by the Brooklyn Grade Crossing Comn., 44 Court St., for the work on Section 2 of the Brighton Beach improvement; this section is about 2½ miles in length. The entire work of Sect. 2 calls for 230,000 cu. yds. earth excav.; 43,500 cu. yds. retaining walls; 6 highway bridges; 150 tons girders and poles; overhead construction; 150,000 duct ft. vitr. clay conduits, 450 cu. yds. reinforced concrete and 600 cu. yds. cinder concrete arches on highway bridges; 12,500 lin. ft. wrought iron fence.

White Plains, N. Y.—The New York, New Haven & Hartford R. R. Co., which owns the Port Chester trolley lines, is stated to have filed a certificate of extension in the County Clerk's office for the construction of its double-track road between White Plains and Portchester. The route will be almost parallel to Westchester Avenue, and the length of the proposed extension will be about 5 miles.

Cleveland, O.—The Bd. of Pub. Service is reported to be receiving bids for building 1½ miles of electric railway frrom Kinsman St. south to the new Cleveland Farm Colony. The city will own and operate the line.

Fremont, O.—F. D. Carpenter, of the Western Ohio Ry. is stated to have been securing right of way for the proposed line from Fostoria to Fremont, in which G. H. McDonel, J. W. S. Riegle and others are interested.

Sandusky, O.—J. C. Parker, promoter of the Sandusky, Clyde, Tiffin & Southern Ry. is reported to be securing right of way and claims his project will be pushed to completion.

Enid, Okla. Ter.—The Enid City Council is stated to have granted a street railway franchise to Daniel S. Roberts, of Baltimore, Md.

Northumberland, Pa.—The Northumberland Council is reported to have passed the ordinance granting the right of way through the town to the river bridge to the Northumberland Traction Co., which is an adjunct of the Lewisburg, Milton & Watsontown Co.

Anderson, S. C.—An application for a charter for an electric railway to Easley is reported to have been made. Capital $100,000. Incorporators, R. Frank Smith, Jos. J. Fredtwell, Isham Harrison, of Walhalla, and others.

Nashville, Tenn.—The Ohio River & Gulf R. R. Co., is reported to have surveyors in the field and they are now running a line from Johnson to Stand on the Tennessee Central R. R. and beyond Monterey to Jamestown, a distance of 32 miles. Incorporators: R. A. Wilson, Nashville; Luke Smith, of Jamestown, Tenn., and others.

Mineral Wells, Tex.—It is stated that at a meeting of the stockholders of the Ft. Worth & Mineral Wells Electric Ry. Co., which was organized here recently with Cicero Smith, Pres.; H. N. Frost, Secy. and Treas.; E. J. Waldron, Gen. Mgr., it was decided to commence surveying a line to Ft. Worth at once, via Whitt, Springtown, Azle to Ft. Worth.

Houston, Tex.—D. P. Shepard, of Houston, and associates, are reported to have been granted a franchise to construct an electric railway over certain roads of the county, adjacent to the city of Houston.

San Antonio, Tex.—It is announced that sufficient funds have been subscribed to insure the building of an interurban electric railway from San Antonio to Campbellton, a distance of about 50 miles. W. A. McCoy, of Campbellton, is reported to be promoting the enterprise.

Tyler, Tex.—John A. Wallace, of Chicago, Ill., is reported to be promoting an interurban electric railway between Dallas and Tyler. The road will be about 125 miles long.

Vancouver, Wash.—Articles of incorporation of the Vancouver & Suburban Ry. Co. are stated to have been filed with the County Auditor. The incorporators: W. H. C. Sugg, John H. Sugg, W. S. Wood and others. Capital, $2,500,000. The object of the new corporation is to build, equip and operate street and suburban railways.

South Bend, Wash.—J. W. Jackenzie, of Portland, Ore., and L. M. Dooly, of Hoquiam, are stated to have applied to the City Council for a franchise for a street car line to run from South Bend to Raymond.

Seattle, Wash.—The Seattle Electric Co. is stated to have announced that work on the new street railway line to Woodland Park will be commenced within a few days. The company was recently granted a franchise by the city to construct a line and operate cars from Blewett Ave. north to 51st St. and to the park.

Fairmont, W. Va.—It is stated that T. J. Conway and C. E. Conway, of this city; A. B. Overhold, of Pittsburg; C. W. Dillinger, of Baltimore, and B. W. Overhold, of Wooster, will ask for a charter for the Fairmont & Fairview St. Ry. Co. It is proposed to build the line from Fairmont to Fairview next spring at a cost of $500,000, and as soon as that portion of the road is complete to go ahead with the building of the line as far as Wheeling.

St. Catharines, Ont.—It is stated that the Hamilton Cataract Power, Light & Traction Co. has decided to expend $150,000 in installing a new plant at De Caw Falls.

RAILROADS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—Articles of incorporation are reported to have been filed in the probate office here by Stuyvesant Fish, of New York, N. Y.; J. T. Harahan, of Chicago, Ill., and other officers of the Illinois Central R. R., for the Alabama Western R. R., which proposes to construct a line in Alabama from a point on the Alabama-Mississippi state line, in Franklin County, to a point at or near Birmingham.

Clio, Ark.—A charter is stated to have been granted to the Anderson & Saline River R. R. Co., to extend its line for a distance of 18 miles from its present terminus. The road runs from Clio to a point in Grant County.

Red Bluff, Cal.—The Red Bluff & Fall River R. R. Co. is reported incorporated, with a capital of $1,000,000, by D. E. Miles, G. K. King and H. P. Stice, of Red Bluff; P. E. Vilas, of Shingletown; O. P. Montelius, of Oakland, and others, to build a standard-gauge railroad from Red Bluff to Fall River Mills via Shingletown.

Yreka, Cal.—The Scott Valley Ry. Co. is reported incorporated, to build and operate a double or single railway track road from Yreka through Scott Valley to a point on the Pacific Ocean, either in Del Norte or Humboldt Counties; and also from Yreka to Montague; total length estimated at 150 miles. Directors: Chas. E. Loss, Henry F. Wells and John A. Manly, all of San Francisco; capital $1,500,000.

San Francisco, Cal.—The Yosemite Valley R. R. Co. is reported reorganized, and it is stated that work on the proposed railway from Merced to the Yosemite Valley, a distance of 80 miles, will soon commence. Thos. Prather, of the First Nat'l Bank of Oakland, and W. W. Garthwaite, of the Oakland Bank of Savings, are among the directors.

San Francisco, Cal.—E. P. Ripley, of Chicago, Ill., Pres. of the Atchison, Topeka & Santa Fe Ry. Co., is reported to have decided to build a road which will give San Francisco another direct rail connection with Galveston, Tex., and has incorporated the Gulf, Santa Fe & Northwestern Ry. The latter company is to build 350 miles of road from Brownwood northwest to Texico, on the Texas and New Mexico boundary.

Jefferson, Ga.—The right of way for the Gainesville Midland R. R. (Sam'l. C. Dunlap, Gen. Mgr. Gainesville) is reported to have been obtained from this place to the Clarke County line. In addition to the building of the broad gauge from Jefferson to Athens, the present narrow gauge road from Jefferson to Gainesville will be changed to a standard broad gauge road by the time the extension is completed to Athens.

Coeur D'Alene, Idaho.—The Idaho Northwestern Ry. Co. (B. R. Lewis, Pres. Coeur D'Alene) has about 11 miles of track laid at a point on Coeur d'Alene Lake, known as Mica Bay, south to the Reservation line. It has not started to construct on the north end of the road connecting it with Coeur d'Alene as yet, but expects to have this completed some time next year, and will continue on to Emida and Santa on St. Maries River, as soon as right of way can be secured across the Coeur d'Alene Indian Reservation.

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*Items marked thus give the names of parties awarded contracts.

Tulsa, Ind. Ter—The Texas, Tulsa & Gulf R. R. Co. is reported incorporated, with a capital of $10,000,000, to construct a railroad from Tulsa to Matagorda Bay, and eventually connect with Kansas City. M. H. Smythe, of Gainesville, Tex., is one of the directors.

Dawson Springs, Ky.—The Dawson Springs & Madisonville R. R. Co. is reported incorporated with a capital of $100,000 to construct a railroad from Dawson to Madisonville.

Minneapolis, Minn.—The Minneapolis & St. Louis R. R. Co. (H. G. Kelley, Ch. Engr., Minneapolis) is reported to have decided to take out all the old steel rails between Minneapolis and Omaha and between Minneapolis and Des Moines, replacing them with standard material. These improvements, with grade revision and ballasting on the Western division, will cost about $1,000,000. The work will begin in the spring.

Hazen, Nev.—The Fallon Ry. Co. is reported incorporated. The road is to commence at Hazen and run to Fallon. Directors: Wm. Hood, of San Francisco, Cal.; J. L. Wilcutt, of Oakland, Cal.; J. E. Foulds, Berkeley, Cal., and Frank Shay, Oakland, Cal.; capital $500,000.

Brooklyn, N. Y.—See "Electric Railways."

St. Johnsville, N. Y.—F. K. Baxter, of Utica, is preparing preliminary surveys for a railroad for the Salisbury Steel & Iron Co., from its mine to connect with the N. Y. Central & Hudson River R. R., near St. Johnsville.

Guthrie, Okla. Ter.—Charters have been granted to the Guthrie, Shawnee & Shreveport R. R. Co. with a capital of $9,000,000, and the Colorado, Oklahoma Central & New Orleans R. R. Co., with a capital of $20,000,000. The board of directors is the same for both companies, as well as for the Guthrie, Fairview & Western, chartered about a year ago, and consists of W. S. McCaull, J. G. Trimble and L. Underwood, of Kansas City, Mo.; T. L. Williams and Don C. Smith, of Guthrie, and others.

Huntington, Ore.—The Pacific & Oregon Eastern Ry. Co. is reported incorporated, with a capital of $7,500,000, to build a railroad from Huntington to Alturas, Cal. Incorporators: Wm. R. Tompkins, Thos. M. Cunniff and Edward W. Osann, reported to be residents of New York, N. Y.

Philadelphia, Pa.—The abolition of ten grade crossings on the Germantown and Chestnut Hill branch of the Reading Ry. are contemplated in plans presented on Oct. 16 to the Board of City Surveyors.

Pittsburg, Pa.—A charter is stated to have been granted to the Air Line Tunnel Co., with a capital of $5,000, to construct a tunnel from Grant St. with the southern line of Webster Ave., and westerly line of Wellwood Ave., 413 ft. from the northerly line of Center Ave. Horace F. Baker, of Pittsburg, is the chief promoter.

The Fifth Ave. Tunnel Co. has been incorporated to construct a tunnel from Forbes and Atwood Sts. to Fifth Ave. to Liberty, Twelfth and Smithfield Sts. Senator Wm. Flinn is the chief promoter.

The East End Tunnel Co. is also reported incorporated by the Fording-Morse Syndicate to construct a tunnel from Smithfield and Virgin Alley to Junction Hollow near Central Ave.

Later reports state that the Fording-Morse Syndicate, in which Geo. H. Flinn is interested, will commence actual construction work on the subway system for Pittsburg in the Spring. They already have tunnel rights and charters for surface lines, which give them a short route to the East End, with several radiating lines. The main question now is to get rights for the downtown underground loop. They will also operate the subway system.

Due West, S. C.—The Due West R. R. Co. has been incorporated with a capital of $22,000 to build and operate a standard gauge railway between Due West and Donnalds; length of road will be 4 miles. Incorporators: R. S. Galloway, Rev. James Boyce, R. C. Brownlee, N. B. Clinkscales, and others, all of Due West.

Knoxville, Tenn.—Local press reports state that it is proposed to eliminate certain grade crossings in Knox County, outside of the city; a subway will be constructed at Love's Creek under the crossing of the Southern R. R.; a subway at the Flenniken crossing, of the Louisville & Nashville R. R. in South Knoxville, and a subway at the Mt. Olive crossing of the Louisville & Nashville R. R. The county will pay the expense of the approaches to the subway and the R. R. Co.'s will pay the remainder. W. A. Park, chmn., Knox County Road and Workhouse Comn., is reported interested.

McKinney, Tex.—The Texas, Missouri, Mexico & Pacific Ry. has been incorporated, to construct a railway from McKinney northwest to the Texas-Mexico State line in Cochran County, Texas, about 375 miles; capital, $1,000,000; main office at McKinney. Directors, A. Alexander, and M. J. Healy, of Chicago, Ill., and Jesse Shain, J. L. White and J. P. Crouch, of McKinney.

Seymour, Tex.—The Wichita Valley Ry. Co. has completed surveys from Seymour, via Haskell, to Stamford, Tex., a distance of 60 miles, and announced its intention of beginning construction at once. Morgan Jones, Pres.; M. C. Jones, Supt., both of Wichita Falls.

Tacoma, Wash.—Press reports state that the Chicago, Milwaukee & St. Paul R. R. Co. (D. J. Wittemore, Ch. Engr., Chicago, Ill.) proposes building its line to the coast. The plans for the terminals is Tacoma are reported to include large docks.

North Yakima, Wash.—R. E. Strahorn is reported interested in a railroad to be constructed from North Yakima to the coalfields on the west slope of the Cascade Mountains.

Seattle, Wash.—Articles of incorporation of the Seattle & Northwestern R. R. Co. are reported to have been filed with the Secretary of State Oct. 4; capital $3,750,000. Incorporators: James A. Moore, Loren H. Mershon, Louis Steckler, M. M. Lyter and M. Ray Wood.

Parkersburg, W. Va.—Press reports state that the Baltimore & Ohio R. R. Co. (D. D. Carothers, Ch. Engr., Baltimore, Md.) will build an extension of the Little Kanawha R. R. (J. T. Blair, Pres. Parkersburg) to a connection with the roal and coke railroad owned by Senator S. B. Elkins and Henry G. Davis, at Burnsville.

Oshkosh, Wis.—M. C. Phillips, of Oshkosh, Pres. Lake Superior & Southern R. R. Co., writes that it is proposed to construct about 160 miles of railroad through Marquette and Iron Counties; probable cost of work, $3,500,000. It will be constructed in sections.

Kenosha, Wis.—The Wisconsin Central Ry. Co. (C. N. Kalk, Ch. Engr., Milwaukee), is reported to be planning to extend its lines in the western part of Kenosha County.

Saratoga, Wyo.—The Saratoga & Encampment R. R. Co. is reported organized, and it is stated that money has been subscribed for the construction of the first two sections from Denver, Colo., to Wolcott, Wyo. It will later be extended to Seattle, Wash. J. M. Rumsey, of the Rawlins Natl. Bank, Rawlins, is reported interested.

Portage la Prairie, Man.—Chas. S. Mellen, of New Haven, Conn.; Henry F. Upham, and Chas. E. Hamilton, of St. Paul, Minn.; John S. Ewart, of Ottawa, Ont., and Jas. Fisher, of Winnipeg, Man., are reported to be incorporators of the Midland Ry. Co., of Manitoba; capital $500,000. Preliminary arrangements are being made for the grading of a section of the line from Portage la Prairie to the United States boundary, near Emerson. Surveyors are reported to be at work, the intention being eventually to extend the line north to Hudson Bay, to make a summer grain shipping route to Liverpool.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Eureka Springs, Ark.—The Co. Court, it is reported, has appropriated $20,000 for the erection of a court house at Eureka Springs.

Clarksville, Ark.—The County Levying Court, it is stated, has appropriated $10,000 for the erection of a jail here.

San Jose, Cal.—Bids will be received until Nov. 7 by the Bd. Superv. (Henry A. Pfister, Clk.) for installing a steam-heating plant at the County Hospital.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Live Oak, Fla.—See "Water."

**Boise, Idaho.*—Wm. Hamilton, of Des Moines, Ia., it is stated, has secured the contract to erect the hospital at $20,000.

W. H. Gibson, Secy. of State, writes that the work of constructing the proposed capitol will be done under direction of E. E. Quigley, Supt. of Construction; the work complete will cost $800,000. Architects, J. E. Tourtellotte & Co., Boise.

Joliet, Ill.—M. Berscheid, City Clk., writes that it is proposed to shortly ask for plans and specifications for the proposed City Hall; probable cost, $160,000.

Bloomfield, Ind.—It is stated that bids will be received until Nov. 7 by the Co. Comrs. for plumbing and for a heating apparatus for the county jail.

Burlington, Ia.—Bids will be received until Nov. 15 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for installing a plumbing system in the U. S. Post Office at Burlington.

Ft. Des Moines, Ia.—Bids will be received by L. Hardeman, Q. M., U. S. A., Nov. 14, for the construction of cavalry drill hall at Ft. Des Moines, as advertised in The Engineering Record.

Henderson, Ky.—The Fiscal Court, it is stated, is considering the erection of a court house at a cost of $100,000, and that an election will probably be held in Nov. to vote on the question of issuing bonds for this purpose.

**Baltimore, Md.*—Henry Smith & Sons Co., 116 Regester St., it is stated, have secured the contract to erect the building for the Maryland Inst. at Mt. Royal Ave. and Lanvale St., at about $269,235 (bids opened Oct. 3). The front and sides of the building are to be of marble.

Sykesville, Md.—It is stated that Dr. J. Clement Clark, Supt. of the Springfield Hospital for the Insane, is about to have plans prepared for an addition which it is proposed to erect at the hospital at Sykesville.

Holyoke, Mass.—J. W. Donohue, of Springfield, it is stated, has prepared plans for an addition which it is proposed erecting at the House of Providence Hospital at a cost of $10,000.

Springfield, Mass.—The Bd. of Mgrs., of the Industrial House Charities, it is stated, is considering the erection of a nursery bldg., to cost $20,000.

Detroit, Mich.—The Eastern Star, it is stated, is contemplating the erection of a hospital at the Masonic Home, to cost about $20,000.

St. Paul, Minn.—Reed & Stem, Endicott Bldg., are the archts for the proposed auditorium building, which will cost about $250,000.

It is stated that as soon as plans are completed by Cass Gilbert, N. Y. City, N. Y., for the approaches to the Capitol, bids for the construction will be asked by the State Capitol Comn.

**St. Paul, Minn.*—J. E. Pilgrim, of Minneapolis, it is stated, has secured the contract to erect a building at the Soldiers' Home for the mothers, widows and wives, the cost to be $70,000.

St. Cloud, Minn.—It is reported that the St. Raphaels R. C. Hospital recently destroyed by fire, will probably be rebuilt. The Sisters of St. Benedictine, it is reported, had charge of the hospital.

Kearney, N. J.—The Common Council, it is stated, has authorized the Pub. Bldg. Com. to have plans prepared for an engine house to be erected on Kearny Ave., to cost about $10,000.

Newark, N. Y.—It is stated that Henry Cunningham Rew, of Chicago, Ill., has annouced that he will give this village $25,000 with which to erect a building to be used for gymnasium, drill hall and social gatherings.

New York, N. Y.—Raymond F. Almirall, 51 Chambers St., it is reported, has prepared plans for a hospital which the Dept. of Charities intends erecting on Staten Island for the treatment of tuberculosis. The plans provide for 14 buildings, and it is stated, that the cost for the construction alone will be about $2,000,000.

It is stated that all bids received Oct. 17 by Jas. H. Tully, Comr. Pub. Charities, for erecting the municipal lodging house on First Ave. and 25th St., exceeded the appropriation and will probably be rejected. The lowest bid, it is stated, was submitted by Dan'l J. Ryan, at $275,000.

New York, N. Y.—Plans have been filed for a 3-story brick fire house to be erected at 143d St. and Alexander Ave. for the City of New York, at a cost of $60,000. M. J. Garvin, Archt., 3307 3d Ave.

St. George, S. I., N. Y.—Bids will be received until Oct. 30 by Maurice Featherson, Comr. of Docks and Ferries, N. Y. City, for furnishing material and preparing for and building at St. George, S. I., a new ferry house and other structures appurtenant thereto, in connection with the new St. George ferry terminal.

Buffalo, N. Y.—The Comr. of Pub. Wks., it is stated, has recommended that the following bids be accepted for erecting the engine house on Seneca St., bids for which were received Oct. 3: Masonry, J. C. Watson, $10,865; carpenter, Adolph F. Bournique, $6,900; roofing, Geo. Hartmetz, $685; ventilating and heating, Davis & Wright, $1,150; total, $19,600.

Carmel, N. Y.—John W. Towner, Clk. of Superv., writes that about $15,000 to $18,000 will be expended for alterations to county jail and court house, but the work will probably not be done this year. Architect, Wm. J. Beardsley, Poughkeepsie.

West Point, N. Y.—Bids will be received by the Quartermaster, U. S. M. A., West Point, until Nov. 29, for constructing a post headquarters building here, as advertised in The Engineering Record.

Fargo, N. D.—The following are the bids opened on Oct. 12 by the Superv. Archt., Treas. Dept., Washington, D. C., for the construction complete of the extension of the U S. Post-Office and Court House except elevator at Fargo: Lauritzen Bros., Fergus Falls, Minn., $64,642; J. W. Miller, St. Paul, Minn., $64,768; H. N. Leighton, Minneapolis, Minn., $69,985; Northwestern Constr. Co., Wahpeton, N. D., $66,997; O. H. Olson, Stillwater, Minn., $71,592; Morse Contr. Co., Topeka, Kan., $72,900; and C. H. Cramer, Muncie, Ind., $74,000.

Cincinnati, O.—It is reported that the Bd. Pub. Service has authorized the issue of $75,000 bonds for the purpose of erecting an engine house.

Enid, Okla. Ter.—J. F. Danelt, County Clk., writes that all bids opened on Oct. 10 for erecting the court house have been rejected and new bids will be received; probable cost, $100,000. Architect, A. A. Crowell, of Enid.

Guthrie, Okla. Ter.—Bids will be received by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., until Nov. 7 for a low pressure steam heating apparatus for U. S. Post-Office and Court House, at Guthrie, as advertised in The Engineering Record.

Hot Springs, Ark.—It is stated that arrangements are being completed for the erection of a $25,000 jail.

Philadelphia, Pa.—The City Councils' Com. on Police and Prisons, it is stated, has recommended an appropriation of $160,000 with which to erect 2 wings to the county prison at Holmesburg.

*Geo. F. Payne & Co., 401 S. Juniper St., it is stated, have been granted a permit to erect a 1-story infirmary and a 1½-story cottage and stable for the Widener Memorial Home at Broad and Olney Sts., to cost $29,000.

Pawtucket, R. I.—Frank F. Tingley, 75 Westminster St., Providence, will have full charge of the erection of the proposed hospital at Pawtucket, the gift of Frank A. Sayles, of Pawtucket. No architect has been selected as yet. Bids for construction will be called for in the Spring.

**Savannah, Tenn.*—T. R. Briggs, of Trenton, it is stated, has secured the contract to erect the court house at about $20,000.

Ft. Worth, Tex.—The Sisters of the Charity of the Incarnate Word of San Antonio, it is stated, intend erecting a 3-story addition to the St. Joseph's Infirmary in this city, which is to cost about $75,000.

**Stephenville, Tex.*—M. J. Thompson, County Judge, writes that Youngblood Bros., of San Antonio, have secured the contract for erecting the jail for $28,000.

Ft. Monroe, Va.—Bids will be received until Oct. 30 by Capt. R. H. C. Kelton, Q. M., U. S. A., for furnishing material and installing low pressure hot water heating system in quarters No. 1, Ft. Monroe.

Two Rivers, Wis.—It is stated that plans have been forwarded to Washington for a life-saving station which it is proposed erecting here next summer at a cost of $15,000.

Evanston, Wyo.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., until Nov. 22 for the low pressure steam heating apparatus for the U. S. Post-Office and Court House at Evanston, as advertised in The Engineering Record.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Tucson, Ariz. Ter.—It is stated that improvements are to be made in this city by the Southern R. R. (W. H. Wells, Engr. of Constr., Washington, D. C.) at a cost of about $100,000. They will include the erection of a new depot, at a cost alone of about $50,000, the erection of shops, freight houses, etc.

Argenta, Ark.—It is stated that the fraternal societies of this city are contemplating the erection of a fraternal hall on Main St., to cost $15,000.

Napa, Cal.—See "Electric Railways."

**Long Beach, Cal.*—Hall & Alpeter are stated to have secured the contract for erecting a bank building at Pine and 1st Sts., for $125,000.

**Los Angeles, Cal.*—Carl Leonardt is stated to have secured the contract for erecting the Majestic Theatre at Bway. and 6th St., for about $450,000. Architect, A. F. Rosenheim, of Los Angeles.

Denver, Colo.—The F. E. Edbrooke Architect Co., 510 Opera House Blk., it is stated, has prepared plans for a 2-story brick warehouse and store room which is to be erected on Wazee and 15th Sts. for the Moore Hardware & Iron Co., at a cost of about $20,000.

The Kentucky Society of Denver, it is stated, is considering the erection of a home near this city for consumptives from Kentucky, the cost to be about $100,000. Dr. E. P. Dameron may be able to give further information.

Items marked thus give the names of parties awarded contracts.

**New Haven, Conn.*—The H. Wales Lines Co. is the general contractor and the L. C. Bates Co., owner, mason and carpenter, for an 8-story cold storage, to cost about $18,000. Architect, L. W. Robinson, Exchange Bldg.

**Wilmington, Del.*—The Pennsylvania R. R. Co., it is stated, has awarded to the American Bridge Co. of N. Y. City, N. Y., the contract for the structural iron and steel work for the new passenger station, which they propose erecting in this city.

Augusta, Ga.—T. O. Brown & Son are reported to be preparing plans for a $12,000 warehouse for J. W. Hollingworth, to be erected on 6th and Walker Sts.

Springfield, Ill.—It is stated that plans are being prepared for a 3-story brick store and apartment house which is to be erected on 4th St. by Frank McGowan and others at a cost of $33,000.

Chicago, Ill.—Plans are being prepared for the remodeling of the historical "House of David," 162-164 Clark St., which was recently purchased by J. W. Stevens, Pres. of the Illinois Life Insurance Co., into a structure for offices and light manufacturing at an expenditure of $50,000.

Jenney, Mundie & Jensen, 171 La Salle St., are the architects chosen for the remodeling of the Open Board of Trade Bldg. into a modern office building at an expense of $50,000. Benj. I. Greenebaum is reported interested.

**South McAlester, Ind. Ter.*—C. W. Clark, of Little Rock, Ark., it is reported, has secured the contract to erect the Masonic Temple, at $125,000.

**Indianapolis, Ind.*—Geo. Anderson, 331 E. Market St., it is stated, has secured the contract to erect a laboratory building on Capital Ave. and Wabash St. It is to be a 4-story structure, and with equipments, it is stated, will cost about $25,000.

Aug. Kiefer, it is stated, has secured a site at Capital Ave. and Georgia St., on which he proposes erecting a 4-story business building to cost $75,000.

It is reported that improvements are to be made to the union station at a cost of $75,000. The Vandalia R. R. Co. (Jas. McCrea, Pres., Pittsburg, Pa.) is reported interested.

Winona, Ind.—It is stated that the Bldg. Com. (J. W. Chapman, Chmn.) will receive bids for erecting a hotel here to cost about $20,000, for the Interdenominational Assoc.

Sioux City, Ia.—Wm. Lerch, it is stated, intends erecting a 4-story store and office building on 5th St., to cost $30,000.

Davenport, Ia.—Temple, Burrows & McLane, McManus Bldg., it is stated, are preparing plans for a club house which is to be erected for the Commercial Club at a cost of $40,000.

Des Moines, Ia.—It is reported that the Gibsons' Coal Mining Co. has purchased the Rice Block and intends making improvements to cost about $40,000.

Wichita, Kan.—The Boston Store, it is reported, intends erecting a 6-story fireproof building, to cost about $175,000.

Paducah, Ky.—The following are reported to be the bids received Oct. 2 for erecting the Elk's Home on N. 5th St.: Geo. Katterjohn, $23,800; Paducah Constr. Co., $23,995 and Acree & Nieman, $24,343.

Lexington, Ky.—It is stated that S. A. Hutchinson, of Ashland, Ky., and several Lexington capitalists, headed by J. Will Stoll, of the City Natl. Bank, are interested in the erection of a hotel here at Cheapside and Short Sts., to cost about $350,000.

New Orleans, La.—Smith Bros. & Co., Ltd., it is reported, have purchased a site on Camp St., and intend erecting a general office and headquarters building.

Camden, Me.—It is stated that plans are being considered for the rebuilding of Bay View House, at a cost of $75,000. Henry E. Capen, Mgr., may be able to give further information.

Baltimore, Md.—A building permit has been granted to erect the 12-story Exchange Arcade Bldg., on German and Calvert Sts., estimated to cost $800,000. Edgar Blair & Co., are the archts.

**Worcester, Mass.*—Henry Mellen & Son, 41 Queen St., are stated to have secured the contract for erecting a brick addition to the brewery of Bowler Bros., Ltd. Architect, W. B. Nourse, Day Bldg.

Fall River, Mass.—The Fall River Woman's Union is reported to be soliciting subscriptions, to erect a $50,000 building. Mrs. Chas. A. Bassett, Treas., 808 Rock St.

**Minneapolis, Minn.*—John Wunder, Lumber Exchange, it is stated, has received the contract for erecting the 3-story brick and stone reinforced concrete fireproof building for the Strong & Northway Mfg. Co., which is to cost about $40,000.

*The Gilmore Co., it is stated, has awarded the general contract to erect their building, at 523 3d St., to John L. Benson, of Minneapolis. The total cost of the building is to be about $18,000.

**St. Paul, Minn.*—Cameron & Co., 719 Ashland St., are stated to have secured the contract for remodeling Mozart Hall, on Franklin St., to cost about $20,000. Owner, P. J. Giesen.

**Omaha, Neb.*—It is stated that contracts have been awarded as follows for work in connection with the erection of the Webster-Sunderland Bldg., at 16th and Howard Sts.: D. L. Shane, mason work, including the basement and all brick work. A. Rosenberry, carpenter work. The Paxton-Vierling Iron Wks., iron and steel. The building is to be 6 stories and will cost about $200,000.

It is stated that bids will be received about Nov. 1 by Fisher & Laurie, Archts., Paxton Blk., for erecting a 5-story brick and stone, 132 x 155-ft. Y. M. C. A. bldg., at 17th and Harney Sts.

Newark, N. J.—A building permit has been granted, according to reports, to W. T. Jancovius, owner, to erect a 5-story brick warehouse at 112 Arlington St., at an estimated cost of $25,000.

Lakewood, N. J.—It is stated that $95,000 has been bequeathed to the Y. M. C. A. by Mrs. Julia J. McCartee and it is stated that it is proposed to erect a building at Lexington Ave and 2d St. next spring.

Put-in-Bay, O.—Ashley & Dustin, it is reported, have completed negotiations for the erection of a pavilion here by a stock company at a cost of $40,000.

Youngstown, O.—It is reported that J. Craig Smith intends erecting a 3-story business building on W. Wood St., to cost $40,000.

Cincinnati, O.—The Heuck Opera House Co., it is stated, intends erecting a theatre on Vine St., to cost $700,000. Jas. Fennessy is a member of the company.

**Oklahoma, Okla. Ter.*—The Gross Constr. Co., it is stated, has secured the contract to erect the Geo. Hales Bldg., between Bway. and the Santa Fe tracks, at a cost of $20,000.

Philadelphia, Pa.—A building permit has been granted to S. B. MacDowell & Son, to erect a warehouse on American St., near York, for J. B. S. Rex & Co., to cost $60,000.

York, Pa.—Wm. A. Riest, it is stated, is interested in the project to erect an 8-story fireproof hotel in Market and Beaver Sts.

Pittsburg, Pa.—It is stated that plans are being prepared for a 2-story and basement concrete garage which is to be erected for the Atlas Automobile Co., on Penn Ave., East End, at a cost of about $25,000.

Memphis, Tenn.—It is reported that the hotel owned by F. G. Jones, recently destroyed by fire, will probably be rebuilt.

Knoxville, Tenn.—It is stated that plans are being prepared for a 6-story brick business building for J. W. Borches &Co., which is to be erected on Jackson Ave.

Chattanooga, Tenn.—The Southern R. R. Co. (W. H. Wells, Engr. Constr., Washington, D. C.), it is reported, intends erecting a depot here to cost $500,000.

Lampasas, Tex.—The Hanna Springs Co., it is reported, has been incorporated with a capital of $50,000, for the purpose of developing the springs and erecting a hotel, bath houses, swimming pools, etc., at Hanna Springs. J. F. White and H. V. Campbell, of Lampasas, are the incorporators.

Burlington, Vt.—It is stated that plans are being prepared for an office building for the N. E. Telegraph & Telephone Co., to be erected at 250 College St., to cost $20,000.

Bennington, Vt.—The committee, it is stated, has decided upon the site at Main and School Sts. on which it is proposed erecting the Y. M. C. A. building, to cost about $25,000.

Spokane, Wash.—The Washington Water Power Co., it is reported, has accepted the plans prepared by Cutter & Malmgren, Exchange Bldg., for the 4-story and basement station and office building which is to be erected on Front Ave. and Lincoln St., 125 x 55 ft.

*It is reported that M. C. Murphy has secured the contract to erect the business block for Judge Geo. Turner, to cost $75,000.

Aberdeen, Wash.—A. R. Dubney, it is reported, contemplates erecting a business block and opera house here to cost $75,000.

**Seattle, Wash.*—Molloy & Lamont, it is reported, have secured the contract to erect the annex to Hotel Diller, at $18,000.

Milwaukee, Wis.—Fred. Graf, 307 Grand Ave., it is stated, has prepared plans for a 4-story brick business building to be erected on Bway. and Chicago St., by A. L. Kern, at a cost of $22,000.

**Viroqua, Wis.*—Albert Spillman, it is stated, has secured the contract to erect a brick and stone depot here for the La Crosse & Southeastern Ry. Co., which is to cost about $45,000.

NEW YORK, N. Y.

286 Spring St., 6-story br. and stone factory; c, $25,000; o, Chas. and John McCory; a, Bolton & Whittal.

Washington and Bank Sts., 3-story br. and stone warehouse; c, $28,000; o, Western Electric Co.; a, Chas. Baxter & Co.

Amsterdam Ave. and 139th St., 2 5-story br. and stone tenements and stores; total c, $120,000; o, Silverson & London; a, Geo. F. Pelham.

25 W. 31st St., 10-story br. and stone loft bldg.; c, $100,000; o, Saml. E. Jacobs; a, W. G. Pigueron.

34th St. and 6th Ave., 6-story br. and stone loft bldg.; c, $150,000; o, Saml. Green; a, Saml. Sass.

527 W. 41st St., 5-story br. and stone storage bldg.; c, $20,000; o, Loewers Brewing Co.; a, Geo. Butz.

316 E. 49th St., 6-story br. and stone store and tenemt.; c, $45,000; o, Kay & Martin; a, Saml. Sass.

243 E. 78th St., 2 6-story br. and stone stores and tenemts.; total c, $90,000; o, Kramer & Rockmore; a, Geo. F. Pelham.

98th St. and 2d Ave., 6-story br. and stone store and tenemt.; c, $50,000; o, Rothstein & Wolf; a, Horenburger & Straub.

112th St. and Park Ave., 6-story br. and stone store and tenemt.; c, $30,000; o, Richman & Greenfield; a, Maximilian Zipkes.

344 E. 118th St., 6-story br. and stone tenemt.; c, $25,000; o, Bertha C. Gottlieb; a, Wm. C. Sommerfeld.

123d St. and 1st Ave., 2 6-story br. and stone stores and tenemts.; total c, $80,000; o, Lampert & Schwartz; a, Horenburger & Straub.

1st Ave. and 107th St., 2 6-story br. and stone tenemts.; total c, $75,000; o, Romm Bros.; a, Bernstein & Bernstein.

109th St. and Columbus Ave., 6-story br. and stone store and tenemt.; c, $35,000; o, M. S. A. Wilson; a, Saml. Sass.

Lenox Ave. and 116th St., 4-story br. and stone office bldg.; c, $100,000; o, Max Rosenblum; a, Lorenz F. J. Weiher.

Amsterdam Ave. and 166th St., 6-story br. and stone store and tenemt.; c, $25,000; o, Nathan Wilson; a, B. W. Levitan.

Amsterdam Ave. and 165th St., 2 5-story br. and stone stores and tenemts.; total c, $70,000; a, Shapiro & Shapiro.

150th St. and Morris Ave., 5-story br. stores and tenemts.; c, $50,000; o, Sanita Realty & Constr. Co.; a, Louis Falk.

Audubon Ave. and 166th St., 6-story br. and stone tenemt. and store; c, $90,000; o, Ellen Ryan; a, Henri Fouchaux.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Denver, Colo.—T. E. Fisher, it is stated, has prepared plans for a 3-story apartment house which is to be erected on Emerson and 19th Aves. by Geo. D. Reynolds.

Wm. E. Fisher, it is stated, has prepared plans for a brick residence, to be erected on Clark St. and 7th Ave., for E. G. Bennett, of the law firm of Bixler, Bennett & Nye, the cost to be about $20,000.

Colorado Springs, Colo.—Wagner & Manning, it is stated, have been engaged to prepare plans for a 4-story apartment house, which is to be erected on Pike Peak Ave., to cost $30,000.

It is reported that C. A. Baldwin is preparing to erect a residence to cost $50,000.

Boston, Mass.—C. H. Bartlett, 597 Massachusetts Ave., Cambridge, is preparing plans for a brick apartment house to be erected in Pleasant St., Arlington, for Geo. D. Moore; estimated cost $40,000.

Omaha, Neb.—A Bldg. Com., of which Rev. Thos. J. Mackey, Rector, is a member, has been appointed to have charge of the erection of a new edifice for All Saints' Church, the cost to be about $30,000

**Lorain, O.*—The Carey Constr. Co., of Lorain, it is reported, has received the contract to erect the R. C. Church in South Lorain, at $40,000.

**Shawnee, Okla. Ter.*—It is reported that the contract to erect 3 buildings, including hall and dormitories, for the Shawnee Indian Mission, has been awarded to W. D. Lovell, of Indianapolis, Ind., for $31,700.

**Wynnewood, Pa.*—Stacy Reeves & Sons, 1611 Filbert St., Philadelphia, it is stated, have secured the contract to erect a residence in Wynnewood for Isaac H. Clothier, the cost to be about $20,000.

Pittsburg, Pa.—Cram, Goodhue & Ferguson, of Boston, Mass., it is stated, have been engaged to prepare plans for an edifice and parish house for Calvary Episcopal Church which are to be erected at Shady Ave. and Walnut St. It is stated that bids for the improvements will be asked about Nov. 15, and the cost is reported to be about $300,000.

Providence, R. I.—The congregation of the Swedish Lutheran Gloria Del Church, it is reported, has decided to erect a new edifice at a cost of $30,000.

Memphis, Tenn.—L. M. Weathers, Cotton Exchange Bldg., it is stated, is preparing plans for 2 flats which are to be erected by Horn Bros., at Vance and DeSoto Sts., at a cost of $75,000.

**Danville, Va.*—Deitrick & Pearson, of Danville, it is stated, have secured the contract to erect a Baptist Church here to cost about $22,000. S. W. Foulk & Sons, of Greensboro, N. C., are the archts.

NEW YORK N. Y.

65 Riverside Drive, 9-story br. and stone apartment house; c, $450,000; o, Mrs. Albertina Miller; a, Geo. F. Pelham.

Cathedral Parkway and Manhattan Ave., 6-story br. and stone tenemts.; c, $50,000; o, M. S. A. Wilson; a, S. Sass.

132d St. and Amsterdam Ave., 3 6-story br. and stone tenemts.; total c, $132,000; o, A. M. & W. M. Janpole and Louis Werner; a, John Hauser.

174th St. and Amsterdam Ave., 2 5-story br. and stone tenemts.; total c, $80,000; o, Wallach & Reisler Co.; a, Moore & Landsiedel.

178th St. and St. Nicholas Ave., 5-story br. and stone tenemt.; c, $26,000; o, A. M. & W. M. Janpole and Louis Werner; a, John Hauser.

152d St. and Morris Ave., 5-story br. tenemt.; c, $60,000; o, Maurice Muller; a, Moore & Landsiedel.

Jackson Ave. and Home St., 2 5-story br. tenemts.; total c, $85,000; o, Wolf & Brody; a, David Stone.

Washington Ave. and 173d St., 2 5-story br. tenemts.; total c, $100,000; o, Ury Goodman; a, Edward A. Meyers.

137 Baxter St., 6-story br. and stone tenement; c, $25,000; o, Israel Lippman; a, Bernstein & Bernstein.

27th St. and 2d Ave., 2 6-story br. and stone tenements; total c, $75,000; o, Max Lefkowitz; a, B. W. Leviton.

202 E. 113th St., 6-story br. and stone tenement; c, $45,000; o, Polsten Realty Co.; a, Bernstein & Bernsten.

434 E. 117th St., 6-story br. and stone tenement; c, $37,500; o, Empire Cornice Wks.; a, Bernstein & Bernstein.

118th St. and Pleasant Ave., 3 6-story br. and stone tenements; total c, $120,000; o, Max Rubens; a, Bernstein & Bernstein.

115th St. and Morningside Ave., 2 6-story br. and stone tenements; c, $190,000; o, Paterno Bros.; a, Schwartz & Gross.

132d St. and Park Ave., 6-story br. and stone tenement; c, $45,000; o, Samuel Greenstein; a, E. A. Meyers.

137th St. and 5th Ave., 4 6-story br. and stone tenements; total c, $140,000; o, Goldberger & Sotz; a, Horenburger & Straub.

173d St. and Audubon Ave., 2 5-story br. and stone tenements; total c, $70,000; o, Mutual Constr. Co.; a, Jacob H. Amsler.

Claremont Ave. and 125th St., 6-story br. and stone tenement; c, $150,000; o, John V. Signell Co.; a, Neville & Bagge.

Riverside Drive and 135th St., 6-story br. and stone tenement; c, $150,000; o, J. V. Signell Co.; a, Neville & Bagge.

5th Ave. and 126th St., 6-story br. and stone tenement; c, $240,000; o, The Collins Bldg. & Constr. Co.; a, Frank S. Lowe.

135th St. and St. Ann's Ave., 2 6-story br. tenements; total c, $90,000; o, David Zipkin; a, Samuel Sass.

151st St. and Morris Ave., 2 6-story br. tenements; total c, $80,000; o, Chas. Reinecke; a, Moore & Landsiedel.

155th St. and Elton Ave., 5-story br. tenement; c, $40,000; o, Prescott Realty Co.; a, Neville & Bagge.

Bathgate Ave. and 173d St., 2 5-story br. tenements; total c, $84,000; o, Rosenzweig & Elson; a, Goldner & Goldberg.

Washington Ave. and 174th St., 3 5-story br. tenements; total c, $105,000; o, L. Livingston; a, Samuel Sass.

140th St. and Bway., 4-story br. and stone chapel and convent; c, $65,000; o, Corporation of St. Regis; a, Jos. H. McGuire.

Items marked thus give the names of parties awarded contracts.

SCHOOLS.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—It is stated that on Oct. 11 the Bd. Pub. Wks. approved the plans for the Washington Grammar School, and that bids for its erection will probably soon be asked. Appropriation, $119,000.

**Washington, D. C.*—Gleeson & Humphrey, of Washington, have secured the contract for erecting Francis L. Cardozo School for $42,600.

Bloomington, Ind.—The Trus. of the Indiana Univ., it is stated, have accepted the revised plans for the library and the contract for the construction will probably be let in December. Probable cost, $100,000.

Indianapolis, Ind.—J. T. Johnson, 1113 State Life Bldg., has been appointed Supervising Archt. of the Indiana Industrial School for Girls, to be erected on the Crawfordsville Road, 8½ miles from Indianapolis.

Rumford Falls, Me.—The erection of a high school at a cost of about $40,000, is reported under consideration.

**Malden, Mass.*—John J. Prindiville, of South Framingham, is stated to have secured the contract for constructing the school at Malden for $43,000. Edw. I. Wilson, 101 Tremont St., Boston, Archt.

Saugus, Mass.—Bids will be received until Nov. 1 by the Com. on New School Houses (Wm. E. Ludden, Chmn.) for erecting a 10-room brick high school. Prescott & Sidebottom, Archts., 113 Devonshire St., Boston.

Duluth, Minn.—It is stated that the Bd. Educ. has decided to receive competitive plans for a 10-room school to cost $35,000, which it is proposed to erect on 6th St., West Duluth. It is also stated that the Bd. intends erecting a graded school on Central Ave., West Duluth, to cost about $50,000.

Jersey City, N. J.—Bids will be received until Oct. 26 by the Bd. Educ. (Fred. Ege, Secy.) for furnishing material and erecting School No. 30, Seaview Ave. Bids may be submitted on the entire work or separately as follows: Masonry; carpentry; plumbing; ventilating and heating, etc. John T. Rowland, Jr., Archt., 15 Exchange Pl.

**New York, N. Y.*—The following are the bids opened on Oct. 16 by C. B. J. Snyder, Supt. School Bldgs., for the general construction, etc., of Public School 4, Boro. of Manhattan: P. J. Walsh, 503 5th Ave., $130,900 (awarded contract); Patrick Sullivan, $147,400; Alfred Nugent's Son, $142,500; Chas. H. Peckworth, $143,443; Richard E. Heningham, $146,203; Edmund D. Broderick, $153,000; Thos. Cockerill & Son, $143,039; P. J. Brennan, $146,500; Geo. Hildebrand, $153,400.

*Bids were opened same time and place for general construction, etc., of additions to and alterations in School 158, Boro. of Manhattan: Alfred Nugent's Son, $67,500; J. & L. Moreland Co., $68,245; Francis Sullivan, $66,000; Thos. Cockerill & Son, 220 4th Ave., $64,700 (awarded contract); Thos. McKeown, $65,772; Wm. Werner, $67,550; Patk. Sullivan, $67,690.

*Bids were opened same time and place for installing ventilating and heating apparatus for additions to and alterations in School 10, Boro. of Bronx: Frank Dobson, 218 E. 42d St., $13,568 (awarded contract); E. Rutzler Co., $14,033; Evans, Almirall & Co., $15,355; R. W. Hillman, $14,800, and Geo. A. Suter, $13,658.

*Danl. J. Rice has secured the contract for installing ventilating and heating apparatus and electric bells in temporary School No. 7, Boro. of Manhattan (bids opened Oct. 16) for $5,683.

*The following are the bids opened on Oct. 9 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for general construction, etc., of additions to and alterations in School 28, Bronx Boro.: P. J. Brennan, $149,500; Wm. Werner, $142,980; Patk. Sullivan, $148,000; P. J. Walsh, 503 5th Ave., $133,000 (awarded contract);, and Thos. Cockerill & Son, $143,703.

*Rubin Solomon & Son, 949 Bway., have secured the contract for erecting outside iron stairs at School 141, Manhattan Boro. (bids opened Oct. 9) for $4,474.

**Brooklyn, N. Y.*—John Kennedy & Son, 175 Front St., have secured the contract for erecting Eastern District High School, Brooklyn Boro. (bids opened Oct. 2) for about $485,000.

Bids will be received until Oct. 30 by C. B. J. Snyder, Supt. of School Bldgs., N. Y. City, for the general construction of school No. 148, Boro. of Brooklyn, also same date for the plumbing and drainage of said building.

Gloversville, N. Y.—The plans of Wilson Potter, 3 Union Sq., New York, N. Y., have been adopted for a high school for Gloversville, to cost $100,000, and bids for construction will be received by the Bd. of Educ. on Oct. 30.

Buffalo, N. Y.—A report of the School Com. has been adopted by the Bd. Aldermen, authorizing bids to be received for erecting a 16-room school in Huntington Ave. Dist. No. 22.

**Long Island City, L. I., N. Y.*—The following are the bids opened Oct. 9 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for general construction, etc., of School 86, Boro. of Queens: Alfred Nugent's Son, $171,790; Thos. Cockerill & Son, $173,741; Richard H. Carman, $196,000; Chas. H. Peckworth, $177,775; P. J. Walsh, 503 5th Ave., N. Y. City, $169,000 (awarded contract), and Geo. Hildebrand, $171,844.

Cincinnati, O.—John C. Olmstead, Landscape Archt., of Boston, Mass., it is reported, is seeking a site in this city, on which it is proposed erecting a Hebrew Union College, to cost about $100,000.

**LaGrange, Ore.*—J. L. Slater, it is stated, has secured the contract to erect a school here at $12,500.

Sharpsburg, Pa.—Bids will be received until Oct. 26 by the Bd. Dirs. of the School Dist. (Robt. W. Moore, Secy., 413 Wood St., Pittsburg) for $75,000 school bonds.

**Philadelphia, Pa.*—Geo. F. Payne & Co., 401 S. Juniper St., it is stated, have secured a contract to erect an infirmary stable and tool house on the grounds of the Widener Memorial Training School for Crippled Children at Broad St. and Olney Ave., at a cost of $29,000.

Nashville, Tenn.—Plans have been submitted to the Trus. of Vanderbilt Univ. by Carpenter & Blair, of N. Y. City, N. Y., for a library which is to be erected at the Univ. at a cost of about $125,000.

Brady, Tex.—It is stated that bids will be received until Oct. 31 by the Bd. Trus. for erecting a 2-story stone school. J. B. Lockhart, Secy. School Bd.; S. P. Herbert, Archt., Waco.

Ft. Worth, Tex.—The School Bd. is said to be considering the erection of another high school.

The Bd. of Mgrs. of the Ft. Worth Medical College, it is stated, has engaged Rolaff & Wright, to prepare plans and specifications for a new building to be erected on 5th and Calhoun Sts., to cost about $40,000.

Norfolk, Va.—It is stated that the erection of a school at a cost of $60,000 is under consideration.

Seattle, Wash.—Reuben W. Jones, Secy. School Bd., writes that the citizens voted Oct. 7 to issue $500,000 bonds, to be used for the construction of a high school and graded schools, as may be needed. Architect, Jas. Stephen, 727 New York Blk.

Delafield, Wis.—It is stated that plans are being prepared for a building to replace De Koven Hall at St. John's Military Academy, which was recently destroyed by fire. E. E. Smythe, of Milwaukee, Secy. of the Academy, it is stated, has announced that it is proposed to spend about $40,000 on the new structure.

Milwaukee, Wis.—It is stated that plans have been prepared for a 3-story and basement brick and stone State normal school, which it is proposed erecting at 25th and State Sts.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Rockford, Ill.—H. C. Scovill, City Clk., writes in regard to the construction of a garbage reduction plant, that the city is doing a little investigating, nothing more.

Chicago, Ill.—J. M. Patterson, Comr. of Pub. Wks., Wm. S. Hard, also Richard T. Fox, Supt. of Street and Alley Cleaning, have been authorized by the Council Finance Com. to visit Eastern cities to secure information on garbage disposal.

Detroit, Mich.—At a special meeting of the Bd. of Estimate on Oct. 12, the question of issuing $100,000 bonds for the establishment of a municipal garbage plant was referred to the Committee on Health, which committee will later on make a report.

Jersey City, N. J.—Dr. G. K. Dickinson and Comr. Geo. M. McCarthy, of the Bd. of Health, are reported to be working up a plan whereby they hope to procure for the city a crematory for the disposal of garbage.

Perth Amboy, N. J.—Tht Bd. of Health is reported to be discussing the question of constructing a garbage crematory.

New York, N. Y.—Bids will be received until Oct. 30 by John McG. Woodbury, Comr. of Street Cleaning, for furnishing material and constructing a second floor in the rubbish incinerator at Delancy Slip, Boro. Manhattan.

York, Pa.—Bids will be received until Oct. 25 by E. F. Weiser, Clk. Sanitary and Highway Committees, for the disposal of garbage from April 2, 1906, for a period of 5 yrs., and also for a period of 10 yrs. Bids are asked separately on the following for the collection and disposal of inorganic garbage, collection of organic garbage; collection and disposal of organic garbage; collection and disposal of inorganic and organic garbage.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

Veitch-Matthews Foundry & Machine Co., Bessemer, Ala., is erecting a new plant to consist of foundry 60 x 76 ft., machine shop 30 x 26 ft., and carpenter shop 20 x 30 ft. This company is in the market for equipment for both machine and carpenter shops.

The Central Mills (J. J. Mangham, Pres.) Griffin, Ga., mfrs. of cotton fabrics, are preparing plans for a new plant. Details not yet perfected.

Mr. J. Gaisser, Isbell, Ala., is constructing a new plant, and is in the market for a 10 or 12 h.p. gasoline engine.

Standard Sanitary Mfg. Co., Detroit, Mich., is constructing a new plant consisting of main building, 300 x 60 ft., 3 stories; foundry building, 60 x 70 ft.; power house, 42 x 95 ft.; dry kiln, 40 x 120 ft.; bath tub building, 60 x 90 ft. A power plant of approximately 400 h.p. will be installed.

The W. P. Davis Machine Co., Rochester, N. Y., is preparing for the erection of a new plant, which, with its equipment, will cost in the neighborhood of $100,000. The new plant will consist of four buildings, of brick and steel construction, and will be equipped throughout with latest improved machinery.

The Washington Brewing Co., Columbus, O., recently organized, is preparing plans for a 50,000-barrel brewery. Mr. Geo. F. Mooney, Wyandotte Bldg., Columbus, is secretary of the company.

The World's Star Knitting Co., Bay City, Mich., is contemplating building a new plant in the spring. Plans not yet definitely determined.

The Hudson Mfg. Co., Hudson, Mich., is erecting a new building measuring 35 x 140 ft., 2-story and basement. An 80-h.p. plant will be installed, and the company contemplates the use of individual electric drives.

W. T. Jancovius & Son, Newark, N. J., will erect a new plant consisting of main building and power house, to cost $25,000, according to local newspaper reports.

The Great Northern Railroad Co. has acquired site for the erection of extensive repair shops in Minneapolis, Minn., according to local newspaper reports.

W. E. Owens & Son, Utica, N. Y., will erect a large grain elevator, according to local newspaper reports.

M. L. Paddock has secured site for a large storage warehouse at Marion, O., it is reported. The new structure will be of fireproof construction throughout and equipped with large elevators and other appliances for loading and unloading materials.

The M. J. Drummond Co. is preparing to erect a $1,000,000 pipe plant at Norfolk, Va., according to local newspaper reports.

The Brooklyn Range Boiler Co. has purchased site in Long Island City for a large plant, according to local newspaper reports.

The Kansas City Motor Car Co. has begun the erection of a new plant, according to local newspaper reports.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Washington, D. C.—See 'Power Plants, Gas and Electricity."

Jacksonville, Fla.—See "Water."

Key West, Fla.—Bids will be received by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., until Dec. 2, for constructing a concrete quay wall at the Naval Station, Key West.

Greenfield, Ind.—The Co. Comrs. are reported to be preparing to receive bids for the construction of Collingswood ditch.

Muncie, Ind.—It is reported that bids will be received by the County Comrs. at their November meeting for an elevator to be placed in the court house; probable cost, $5,000.

Marshalltown, Ia.—The following are the bids opened on Oct. 10 by the Bd. of Superv. for constructing about 4 miles of open drainage ditch. Geo. La Plant, 10, 13 and 14 cts. per cu. yd.; total cost, $3,480, and R. A. Lackey, 12, 12½, 15 and 16 cts. per cu. yd.; total cost, $4,065.

Onawa, Ia.—Bids will be received by the Bd. of Superv. until Nov. 6 for the excavation of Cleghorn Ditch, estimated cu. yds. 125,000, as advertised in The Engineering Record.

Sioux City, Ia.—The Bd. of Supervisors are reported to have decided to construct the Farmers Ditch, and J. M. Lynch, of Sioux City; Geo. A. Bailey, of Correctionville, and City Engr. J. M. Lewis, of Sioux City, were appointed as a commission to appraise the benefits of the ditch; probable cost of improvements, including damages, etc., is $300,000.

New Orleans, La.—The following are the bids opened on Oct. 14 by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for filling and grading at the Naval Station, New Orleans (price given per cu. yd.): Jahncke Navigation & Improv. Co., 816 Howard Ave., $1, and John J. Keegan, 3607 Magazine St., 62½ cts.

**New Orleans, La.*—Contracts for levee work are reported to have been awarded by the State Engrs. on Oct. 10, as follows: Herbert Levee, 17,000 cu. yds., to A. Leopold, 17⅛ cts. per cu. yd.; Martin Levee, 20,000 cu. yds., E. A. Schayot, 17⅛ cts.; Orange Farm Levee, 20,000 cu. yds., Jas. A. Clary, 24 cts.; Gregory Levee, 10,000 cu. yds., Jas. Cleary, 18.2 cts., and Waltzer to Nestor Canal Levee, 52,000 cu. yds., Fred Hingle, 15⅔ cts.

Local press reports state that bids will be received until Oct. 24 by the State Bd. Engrs., at New Orleans, for constructing about 350,000 cu. yds. of levee work. The work is to be done on the following levees: Cottonwood to Benhams, East Carroll parish, 28,000 cu. yds.; Mornacy, Madison parish, new levee, 65,000 cu. yds., and Lake Palmyra Section 1, Tensas parish, enlargement, 84,000 cu. yds.

Bids will be received until Nov. 25 by Mordecai T. Endicott, Ch. Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing reinforced concrete drains, curbs and sidewalks at the Naval Station, New Orleans, estimated to cost $17,000.

New Iberia, La.—An election will be held in the Petite Anse-Drainage Dist., in Iberia Parish, early in Dec. to vote on issuing $50,000 bonds to be used for dredging. Between 20 and 23 miles of canals will be dredged, varying in size from 24 to 25 ft. wide and from 3 to 6 ft. deep. For further information address Burke & Burke, Attorneys, New Iberia, La., or Walter Y. Kemper, Engr., Franklin, La.

Columbia, La. — Only one bid was received on Oct. 10 by the Police Jury for constructing Sandy Bayou dike in Caldwell Parish, and the same was rejected, being considered excessive. It was for 16,000 cu. yds., 20 cts. per cu. yd. Committee has decided to ask for new bids the early part of next year.

Muskegon, Mich.—The following are the bids opened on Oct. 11 by Col. M. B. Adams, Corps Engrs., U. S. A., Grand Rapids, for the construction and repair of piers at Muskegon: (1) Lump sum to remove about 328 lin. ft. crib work in North Pier and restore cribs in their new position; (2) lump sum to remove 328 lin. ft. crib work in the North Pier; (3) approximate total, excluding Item 1; (4) approximate total, excluding Item 2: Robert Love, Muskegon, (1) $6,500, (2) $4,000, (3) $51,787, (4) $54,140; (*b*) Bennett-Schnorbach Co., Muskegon, (1) $7,000, (2) $4,000, (3) $58,971, (4) $59,189; (*c*) Burk, Smith & Nelson, Muskegon, (1) $12,000, (2) $8,000, (3) $70,762, (4) $70,340. The following are the detail bids and approximate quantities required to complete total excluding item 1:

	a	*b*	*c*
7,159 cu. yds. dredg. for crib found.	$.20	$.50	$.60
2,397 lin. ft. found. piles for cribs..	.50	.60	.60
21,260 lin. oak piles..............	.27	.30	.32
23.772 M. ft. oak timber..........	50.00	52.00	60.00
326.689 M. ft. pine or fir timber..	32.75	35.00	36.00
463.32 M. ft. pine or fir plank for sheet piles	38.75	44.00	54.00
32.207 M. ft. pine or fir plank for decking	28.50	33.00	32.00
38,741 lbs. drift bolts.............	.035	.03	.04
14,957 lbs. screw bolts.............	.035	.035	.04
13,204 lbs. carriage bolts...........	.035	.05	.04
20,609 lbs. tie rods.................	.035	.035	.04
1,811 lbs. spikes	.035	.035	.04
445 cords stone filling.............	6.25	6.80	7.00
1,000 cu. yds. sand filling..........	.25	.30	.30

St. Louis, Mo.—S. G. Clark, Ch. Clk. to Maj. Thos. L. Casey, Corps Engrs., U. S. A., writes that it is not proposed to ask for new bids for dredging pumps, pillow blocks, etc. The materials required will be purchased in open market, and be built by hired labor. For list of bids received for this work, see issue of The Engineering Record, Oct. 14.

Portsmouth, N. H.—Bids will be received until Nov. 11 by Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C., for the removal of earth and rock at the Navy Yard, Portsmouth. Probable cost $25,000.

Items marked thus give the names of parties awarded contracts.

New York, N. Y.—Bids will be received until Oct. 26 by the Park Bd. (John J. Pallas, Pres.) for constructing that portion of St. Nicholas Park North of 135th St. and East of St. Nicholas Terrace, Boro. Manhattan.

Bids will be received until Oct. 30 by Maurice Featherson, Comr. of Docks and Ferries, for furnishing and delivering 7,500 cu. yds. broken stone.

Bids will be received until Oct. 30 by Maurice Featherson, Comr. of Docks and Ferries, for furnishing and delivering lumber.

The following are the bids opened on Oct. 12 by Col. W. R. Livermore, Corps Engrs., U. S. A., for dredging: (*a*) Port Jefferson Harbor, N. Y., 20,000 cu. yds., (*b*) Flushing Bay, N. Y., 32,000 cu. yds., (*c*) Huntington Harbor, N. Y., 5,800 cu. yds. (price given per cu. yd.): International Contr. Co., 17 Battery Pl., *a* and *b*, 25 cts.; Atlantic Dredging Co., 15 Whitehall St., *a* 29½cts., *b* 29 cts., *c* 34½ cts.; Seely-Taylor Co., 78 Broad St., *a* 35 cts., *b* 32 cts., *c* 36 cts.; R. G. Packard Co., 130 Pearl St., *a* 43 cts., *b* 28 cts. No bids were received for dredging in Canarsie Bay.

**Boston, Mass.*—Wm. H. Ellis, 17 Milk St., is stated to have secured the contract for a pile and timber pier and for dredging at the Boston Navy Yard, for about $38,000.

Brooklyn, N. Y.—Bids will be received until Nov. 1 by Martin W. Littleton, Boro. Pres., for constructing a flushing tunnel and intake and appurtenances, together with the work incidental thereto, for the improvement of the sanitary condition of the Gowanus Canal in Degraw St., from East River to Hoyt St.; in Hoyt St., from Degraw to Butler Sts., and in Butler St., from Hoyt St. to Gowanus Canal. The engineer's estimate of the quantities is as follows: 3,140 lin. ft. flushing tunnel in open-cut construction, 3,130 lin. ft. flushing tunnel in tunnel constr., 4,100 cu. yds. additional brick masonry around flushing tunnel built in tunnel constr., 2,060 cu. yds. additional concrete masonry around flushing tunnel built in tunnel constr., 1,600 cu. yds. concrete masonry in and about intake and outfall; 4,500 cu. yds. excav. in and about intake and outfall; 12,000 lin. ft. bearing piles; 1,250 lin. ft. fender piles; 113 M. ft. temporary sheet piling; 182 M. ft. permanent sheet piling; 540 M. ft. found. planking; 38 M. ft. pile capping; 1,000 M. ft. sheeting and bracing; 3,260 lin. ft. 12, 15, 18 and 24-in. pipe sewer; 20 lin. ft. 36-in. and 20 lin. ft. 60-in. brick sewer; 31 manholes; 2,320 lin. ft. 6-in. house connection pipe drain; 6,400 lin. ft. 12-in. pipe subdrain; 5,000 cu. yds. dredging, etc.; total cost about $750,000.

Oyster Bay, L. I., N. Y.—Bids will be received until Nov. 1 by H. S. Thomson, C. E., 92 Liberty St., N. Y. City, or Oyster Bay, N. Y., for dredging about 37,000 cu. yds. material and filling lowlands.

Cleveland, O.—Bids will be received until Oct. 30 by the Bd. Pub. Service (A. R. Callow, Secy.) for constructing a pile and timber bulkhead across Houston St. and also east Clark Ave.

Cincinnati, O.—Bids will be received until Nov. 1 by the Bd. Pub. Service (Geo. F. Holmes, Clk.), for furnishing material and constructing a retaining wall between E. 6th and Russell Sts., north of E. Court St. and the improvement of Russell St. north to E. Court St.

Columbia, Pa.—Local press reports state that the Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia) proposes constructing 3 subways; also constructing new sewers for this town

**Reading, Pa.*—The Hawman Constr. Co., of Reading, is stated to have secured the contract for constructing a subway under the P. & R. Ry. tracks for $157,276 (bids opened Oct. 5 by the Bd. of Pub. Wks).

Philadelphia, Pa.—Bids will be received until Oct. 28 (readvertisement) by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for dredging and filling in at the reserve basin, Navy Yard League Island, Pa.; appropriation available, $77,000.

Charleston, S. C.—The following are the bids opened on Oct. 14 by Capt. G. P. Howell, Corps Engrs., U. S. A., for dredging bet. Charleston Harbor and Bulls Bay: (*a*) price per cu. yd. place meas.; (*b*) monthly rate of cu. yds.; (*c*) work o begin within: Simons-Mayrant Co., Charleston, S. C., *a* 21.4 cts., *b* 30,000, *c* 59 days; Stono Mines, Charleston, *a* 23 cts., *b* 35,000, *c* 60 days; P. Sanford Ross, Inc., Jersey City, N. J., *a* 23.7 cts., *b* 22,000, *c* 60 days; Southern Dredging Co., Mobile, Ala., *a* 24 cts., *b* 20,000, *c* 40 days; N. American Dredging Co., San Francisco, Cal., *a* 27¾ cts., *b* 30,000, *c* 60 days; Ernest L. Miner, Washington, D. C., *a* 29⅝ cts., *b* 25,000, *c* 90 days; Charles P. Grim, Philadelphia, Pa., *a* 31 cts., *b* 30,000, *c* 90 days.

Ft. Brown, Tex.—Bids will be received until Nov. 7 by Col. F. Von Achrader, Depot Q. M., St. Louis, Mo., for furnishing a 50-hp. boiler at Ft. Brown, Tex.

Whalen, Wyo.—Specifications are on file at the office of The Engineering Record, 114 Liberty St., New York, N. Y., for furnishing f. o. b. cars at stations on the Chicago, Burlington & Quincy R. R. bet. Torrington and Whalen, Wyo., about 10,000 bbl. Portland cement, bids for which will be received at the office of the U. S. Reclamation Service, Denver, Colo., until Nov. 1, as advertised in The Engineering Record.

Guantanamo, Cuba.—Bids will be received until Dec. 2 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Washington, D. C., for constructing a timber and concrete quay wall at the Naval Station, Guantanamo.

PROPOSALS OPEN

For Proposals see pages 56, 60 and 63.

WATER WORKS.

Bids Close.		See Eng. Record.
Oct. 23.	Distributing system, Orange, N. J.	Oct. 14
Oct. 23.	Mains, Avon by the Sea, N. J.	Oct. 14
Oct. 24.	**System, Ciudad Juarez, Mex.**	**Sep. 16**
Oct. 24.	Main, Minneapolis, Minn.	Oct. 14
Oct. 24.	Reservoir, pump engine, etc., Kewanee, Ill. Adv. Oct. 21.	Oct. 21
Oct. 24.	Well, Huntington, Ind.	Oct. 21
Oct. 25.	Pumps, New York, N. Y.	Oct. 14
Oct. 25.	Mains, etc., Brooklyn, N. Y.	Oct. 21
Oct. 26.	Dams, canals, etc., Belle Fourche, S. D. Adv. Sep. 2 to Oct. 21.	Sep. 2
Oct. 28.	Canals, etc., Hood River, Ore.	Oct. 7
Oct. 30.	Water wks., Bassett, Neb.	Oct. 14
Oct. 30.	Well, Ft. Dodge, Ia. Adv. Oct. 14, 21.	Oct. 21
Oct. 31.	Well, Pensacola, Fla.	Oct. 14
Nov. 1.	Water wks., Waverly, Minn.	Sep. 23
Nov. 6.	Conduit, Toledo, O.	Oct. 14
Nov. 6.	Main, Valley City, N. D.	Oct. 21
Nov. 7.	Tank, etc., Ft. Stevens, Ore.	Oct. 21
Nov. 7.	Boilers, etc., St. Louis, Mo.	Oct. 21
Nov. 8.	Irrig. canal, Mitchell, Neb. Adv. Oct. 14, 21.	Oct. 14
Nov. 8.	Canal work, North Platte, Neb. Adv. Oct. 14, 21.	Oct. 14
Nov. 8.	Boilers, Brooklyn, N. Y.	Oct. 21
Nov. 10.	C. I. pipe, Cincinnati, O.	Oct. 14
Nov. 11.	System, East Moline, Ill.	Oct. 21
Nov. 15.	Canals, etc., Buford, N. D. Adv. Sep. 30 to Oct. 21.	Sep. 30
Nov. 15.	Filter plant, Independence, Kan. Adv. Oct. 21.	Oct. 21
Dec. 1.	Water works, Burlington, Wash.	Oct. 14
Dec. 1.	Meters, Chicago, Ill.	Oct. 21
Dec. 5.	Dam, Glendive, Mont. Adv. Sep. 16 to Oct. 21.	Sep. 16
Dec. 15.	Canal work, Billings, Mont. Adv. Oct. 21.	Oct. 21
Jan. 1.	Irrig. work, El Campo, Tex.	Oct. 7
Jan. 2.	Water wks., Manila, P. I.	Sep. 30
—	Tunnel, c. i. pipe, etc., Harrisburg, Pa. Adv. Oct. 7.	Oct. 7
—	Filter, etc., Yuma, Ariz.	Oct. 14

SEWERAGE AND SEWAGE DISPOSAL.

Oct. 23.	Jersey City, N. J.	Oct. 21
Oct. 24.	Cleveland Heights, O.	Sep. 30
Oct. 24.	Minneapolis, Minn.	Oct. 14
Oct. 24.	Laporte, Ind.	Oct. 21
Oct. 25.	Clinton, Ia.	Oct. 14
Oct. 25.	Eveleth, Minn.	Oct. 21
Oct. 25.	Akron, O.	Oct. 21
Oct. 26.	Portsmouth, O. Adv. Sep. 30 to Oct. 21.	Sep. 30
Oct. 27.	Keshena, Wis.	Sep. 30
Oct. 27.	North Platte, Neb.	Oct. 14
Oct. 27.	Des Moines, Ia.	Oct. 21
Nov. 1.	Cleveland, O.	Oct. 21
Nov. 1.	Brooklyn, N. Y.	Oct. 21
Nov. 2.	Columbus, O. Adv. Oct. 7 to 21.	Oct. 7
Nov. 3.	Des Moines, Ia.	Oct. 21
Nov. 4.	Grosse Pointe, Mich.	Oct. 14
Nov. 6.	North Yakima, Wash. Adv. Oct. 21.	Oct. 7
Nov. 6.	Glendale, O.	Oct. 14
Nov. 6.	Napoleon, O.	Oct. 14
Nov. 6.	Plainfield, N. J. Adv. Oct. 21	Oct. 14
Nov. 7.	Guantanamo, Cuba	Oct. 14
Nov. 7.	Chattanooga, Tenn. Adv. Oct. 14, 21.	Oct. 14
Nov. 10.	Aberdeen, S. D.	Oct. 21
Nov. —.	Rockport, Ind.	Oct. 7
Dec. 11.	Sheldon, Ia.	Oct. 14
Jan. 12.	Manila, P. I.	Sep. 30
—	Kirkwood, Mo. Adv. Sep. 30.	Sep. 30
—	Haddonfield, N. J.	Oct. 14

BRIDGES.

Oct. 24.	Marion, O.	Oct. 7
Oct. 25.	Boston, Mass.	Oct. 21
Oct. 26.	Boston, Mass.	Oct. 21
Oct. 26.	Holton, Kan.	Oct. 21
Oct. 28.	Indianapolis, Ind.	Oct. 21
Oct. 28.	San Francisco, Cal.	Oct. 21
Oct. 30.	Camden, N. J.	Sep. 23
Oct. 30.	Refton, Pa.	Oct. 7
Oct. 30.	Aberdeen, Wash.	Oct. 14
Oct. 30.	New York, N. Y.	Oct. 21
Nov. 1.	Portage, Wis.	Sep. 30
Nov. 4.	Akron, O.	Oct. 21
Nov. 6.	San Bernardino, Cal.	Oct. 14
Nov. 6.	Memphis, Tenn. Adv. Oct. 14, 21.	Oct. 14
Nov. 6.	Huntsville, Ala.	Oct. 14
Nov. 6.	Cleveland, Miss.	Oct. 21
Nov. 6.	Jamestown, N. D.	Oct. 21
Nov. 6.	Monte Vista, Colo. Adv. Oct. 21.	Oct. 21
Nov. 7.	Bloomfield, Ind.	Oct. 21
Nov. 7.	Palmyra, Mo.	Oct. 21
Nov. 8.	South Bend, Ind.	Oct. 14
Nov. 8.	Audubon, Ind.	Oct. 21
Nov. 8.	Vale, Ore.	Oct. 21
Nov. 9.	Columbus, O.	Oct. 21
Jan. 1.	Pensacola, Fla.	Sep. 30

PAVING AND ROADMAKING.

Oct. 23.	Jersey City, N. J.	Oct. 21
Oct. 24.	**Columbus, O.**	**Sep. 30**
Oct. 24.	Cincinnati, O.	Oct. 7
Oct. 25.	Hoboken, N. J.	Oct. 14
Oct. 25.	Brooklyn, N. Y.	Oct. 14
Oct. 25.	Altoona, Pa. Adv. Oct. 14.	Oct. 14
Oct. 26.	Cincinnati, O.	Oct. 21
Oct. 27.	Buffalo, N. Y.	Oct. 21
Oct. 28.	Spokane, Wash.	Oct. 14
Nov. 1.	Steelton, Pa. Adv. Sept. 2 to Oct. 7.	Sep. 16
Nov. 1.	Cincinnati, O.	Oct. 14
Nov. 4.	Norwood, O.	Oct. 21
Nov. 4.	Bisbee, Ariz.	Oct. 21
Nov. 6.	Crownpoint, Ind.	Oct. 14
Nov. 6.	Cincinnati, O.	Oct. 21
Nov. 6.	Salem, Ind.	Oct. 21
Nov. 6.	Moundsville, W. Va.	Oct. 21
Nov. 6.	Greensburg, Pa.	Oct. 21
Nov. 7.	Bloomfield, Ind.	Oct. 21
Nov. 9.	Cincinnati, O.	Oct. 21
Nov. 10.	Cincinnati, O.	Oct. 14
Nov. 25.	New Orelans, La.	Oct. 21
Nov. —	Harrison, N. J.	Oct. 21
Dec. 1.	Mattoon, Ill.	Oct. 21

POWER. GAS AND ELECTRICITY.

Oct. 23.	New York, N. Y.	Oct. 14
Oct. 24.	Columbus, O.	Sep. 30
Oct. 24.	Washington, D. C.	Oct. 14
Oct. 24.	New York, N. Y.	Oct. 21
Oct. 25.	Chicago, Ill.	Oct. 21
Oct. 25.	Seabright, N. J.	Oct. 21
Oct. 27.	Danville, Pa. Adv. Oct. 21.	Oct. 21
Oct. 30.	Breese, Ill.	Oct. 21
Oct. 31.	**Washington, D. C.**	**Sep. 30**
Nov. 1.	Chicago, Ill.	Sep. 9
Nov. 1.	Roosevelt, Ariz.	Sep. 16
Nov. 2.	Roosevelt, Ariz.	Sep. 23
Nov. 6.	Ft. Des Moines, Ia. Adv. Oct. 14, 21.	Oct. 14
Nov. 8.	Washington, D. C. Adv. Sep. 30 to Oct. 21.	Sep. 30
Nov. 18.	Tacoma, Wash.	Sep. 30
Nov. 21.	Washington, D. C.	Oct. 21
Dec. 2.	**San Juan, Porto Rico**	**Aug. 19**

BUILDINGS.

Oct. 23.	Vent. and htg. school, Brooklyn, N. Y.,	Oct. 14
Oct. 24.	Plumbg. post bldgs., Ft. Totten, N. Y. Adv. Oct. 14, 21.	Oct. 14
Oct. 24.	Plumbing, etc., court house, New Brighton, S. I., N. Y.	Oct. 14
Oct. 24.	Hall of Records, Springfield, Mass.	Oct. 14
Oct. 25.	Pub. Bldgs., Washington, D. C.	Sep. 16
Oct. 25.	Y. M. C. A. Bldg., New Orleans, La.,	Oct. 14
Oct. 25.	Asylum, Ft. Wayne, Ind.	Oct. 14
Oct. 25.	Plumb., etc., pub. bldg., South Bend, Ind.	Oct. 14
Oct. 26.	Roof work on school, Washington Barracks, D. C. Adv. Sep. 30 to Oct. 21.	Sep. 30
Oct. 26.	School, Youngstown, O.	Oct. 7
Oct. 26.	School, Platteville, Wis.	Oct. 7
Oct. 26.	Htg. pub. bldgs., Brooklyn, N. Y.	Oct. 14
Oct. 26.	School, Jersey City, N. J.	Oct. 21
Oct. 27.	School, Keshena, Wis.	Sep. 30
Oct. 27.	Post bldgs., Ft. Leavenworth, Kan.	Oct. 7
Oct. 30.	School, Lancaster, O.	Oct. 7
Oct. 30.	Hospital bldgs., Overbrook, N. J.	Oct. 7
Oct. 30.	Post bldgs., Ft. Wright, Wash.	Oct. 14
Oct. 30.	Htg. post bldgs., Ft. Monroe, Va.	Oct. 21
Oct. 30.	School, Brooklyn, N. Y.	Oct. 21
Oct. 30.	Ferry house, St. George, S. I., N. Y.,	Oct. 21
Oct. 30.	School, Gloversville, N. Y.	Oct. 21
Oct. 31.	School, Brady, Tex.	Oct. 21
Oct. —	City hall, Fargo, N. D.	Sep. 30
Nov. 1.	Pub. bldg. plans, Salem, Mass.	Sep. 16
Nov. 1.	Schools, Saugus, Mass.	Oct. 21
Nov. 1.	Bus. bldg., Omaha, Neb.	Oct. 21
Nov. 7.	Htg. post office, Guthrie, Okla. Ter. Adv. Oct. 21.	Oct. 21
Nov. 7.	Htg. hospital, San Jose, Cal.	Oct. 21
Nov. 7.	Htg., etc., jail, Bloomfield, Ind.	Oct. 21
Nov. 9.	Court house, Marion, Kan.	Oct. 14
Nov. 14.	P. O. bldg., Colorado Spgs., Colo. Adv. Sep. 23 to Sep. 30.	Sep. 23
Nov. 14.	Drill hall, Ft. Des Moines, Ia. Adv. Oct. 21.	Oct. 21
Nov. 15.	School, Cleveland, O.	Sep. 16
Nov. 15.	Plumb. P. O., Burlington, Ia.	Oct. 21
Nov. 22.	Htg., P. O. Bldg., Evanston, Wyo. Adv. Nov. 21.	Oct. 21
Nov. 29.	Post bldg., West Point, N. Y. Adv. Oct. 21.	Oct. 21
Dec. 1.	Dwelling, Wilmington, N. C.	Sep. 16
Dec. 12.	Remodel. capitol, Bismarck, N. D.	Sep. 30
Dec. —	School, Bloomington, Ind.	Oct. 21
Jan. 1.	Hotel, Davenport, Ia.	Sep. 30
Jan. 10.	Library plans, Toronto, Ont.	Sep. 23
—	Bldg. material, Yuma, Ariz.	Oct. 14

MISCELLANEOUS.

Oct. 24.	Supplies, Pensacola, Fla.	Oct. 7
Oct. 24.	Elevating equipment Philadelphia, Pa.,	Oct. 14
Oct. 24.	Supplies, Washington, D. C.	Oct. 14
Oct. 24.	Wall, New York, N. Y.	Oct. 14
Oct. 24.	Levee work, New Orleans, La.	Oct. 21
Oct. 25.	Dock, Chicago, Ill.	Sep. 2
Oct. 25.	Wharf, Washington, D. C.	Sep. 16
Oct. 25.	Garb. disp., York, Pa.	Oct. 21
Oct. 26.	Park work, New York, N. Y.	Oct. 21
Oct. 27.	Rip rap, etc., New York, N. Y. Adv. Sep. 30 to Oct. 21.	Sep. 30
Oct. 28.	Remov. rock, etc., Portsmouth, N. H.,	Oct. 7
Oct. 28.	Dredging, Philadelphia, Pa.	Oct. 21
Oct. 30.	Dredging, Washington, D. C. Adv. Oct. 7 to 21.	Oct. 7
Oct. 30.	Lumber, New York, N. Y.	Oct. 21
Oct. 30.	Improv. garb. incinerator, New York, N. Y.	Oct. 21
Oct. 30.	Stone, New York, N. Y.	Oct. 21
Oct. 30.	Bulkhead, Cleveland, O.	Oct. 21
Oct. 31.	Dredging, San Francisco, Cal.	Sep. 30
Nov. 1.	Garbage franchise, New Orleans, La.	Sep. 16
Nov. 1.	Jetty, Washington, D. C. Adv. Oct. 7 to 21.	Oct. 7
Nov. 1.	Cement, Whalen, Wyo. Adv. Oct. 14, 21.	Oct. 14
Nov. 1.	Canal, Brooklyn, N. Y.	Oct. 21
Nov. 1.	Retaining wall, Cincinnati, O.	Oct. 21
Nov. 1.	El. ry. franchise, Chico, Cal.	Oct. 21
Nov. 1.	Dredging Oyster Bay, L. I., N. Y.	Oct. 21
Nov. 2.	Remov. wreck, Newport News, Va. Adv. Oct. 14, 21.	Oct. 14
Nov. 2.	Ry. work, Brooklyn, N. Y.	Oct. 21
Nov. 3.	Ammunition hoists, Wash., D. C. Adv. Oct. 7, 21.	Oct. 7
Nov. 3.	Canal work, Port Huron, Mich. Adv. Oct. 14, 21.	Oct. 14
Nov. 3.	Breakwater, Port Burwell, Ont.	Oct. 14
Nov. 4.	Drain, Raymond, Ill.	Oct. 14
Nov. 6.	Garb. disp., New York, N. Y. Adv. Sep. 9 to Oct. 21.	Sep. 2
Nov. 6.	El. Ry. franchise, Woodland, Cal.	Sep. 30
Nov. 6.	Ditch work, Onawa, Ia. Adv. Oct. 21.	Oct. 21
Nov. 7.	Supplies, Guantanamo, Cuba	Oct. 14
Nov. 7.	Boiler, Ft. Brown, Tex.	Oct. 21
Nov. 9.	**Wharf, etc., Havana, Cuba**	**Jul. 29**
Nov. 11.	Remov. earth and rock, Portsmouth, N. H.	Oct. 21
Nov. 20.	Concrete wall, Chattanooga, Tenn. Adv. Oct. 14.	Oct. 14
Nov. 21.	Supplies, Washington, D. C.	Oct. 21
Nov. 25.	Drains, etc., New Orleans, La.	Oct. 21
Dec. 2.	Quay wall, Key West, Fla.	Oct. 21
Dec. 2.	Quay wall, Guantanamo, Cuba	Oct. 21
Dec. 15.	R. R., Manila, P. I.	Sep. 16
Jan. 1.	**Statue plans, Indianapolis, Ind.**	**Jul. 22**
Jan. 9.	Wharf, etc., Auckland, N. Z. Adv. Oct. 14, 21.	Oct. 14
Apr. 2, '06.	**Harbor Work, Valparaiso, Chili,** Adv. Apr. 20 to Sep. 9.	**Apr. 29**
—	**Grading, Baltimore, Md.** Adv. Sep. 30 to Oct. 7.	**Sep. 30**

Items marked thus give the names of parties awarded contracts.